JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

MAY, 1831.

Remarks on the effect of Salt Water in Steam Engine Boilers, and on some other points relating to their structure and use: extracted from a letter to the Editor, written by a gentleman in Boston.

The Committee of the Franklin Institute having expressed a desire to have information of any facts connected with the causes of explosion in boilers, I offer the following, which, although not an instance of explosion, is connected with the subject. A boat was repaired in this place to ply about the harbour. A new boiler of nearly ¼ inch iron was put into it; the fireman soon began to complain that he could not keep up the steam, and the difficulty increased until it was found impossible to raise power enough to drive the boat more than three or four knots an hour, although the furnace was abundantly supplied with fuel, which was thoroughly ignited. At length the boiler began to leak in such quantity as to extinguish the fire, a large rent having been made in the bottom of it. It was found that the part immediately exposed to the flame had bilged outwards, and it appeared to have been so much heated as to have approached a state of fusion. On examining the interior, there was found a deposition of salt and other solid matter, which had accumulated to upwards of two inches in thickness. I have now in my possession a piece of the sediment two inches through. This deposition was effected in less than 20 days, and only, as I was informed, because the *engineer was not aware of the probability of such an occurrence*, nor of the importance of frequently *blowing out* the boiler, when salt water is used. The statement of this fact induces me to repeat a

hint contained in the following extract from a communication in the Boston Evening Gazette, 5th June, 1825.

"We close with a suggestion, which, if adopted, may add one more to the safeguards recommended by others. Fully persuaded, that much of the evil there is so great reason to lament, has arisen from confidence in unqualified persons, we think it would be a good plan to establish a board of examination in all places where steam engines are much used, and to pass a law prohibiting, under severe penalties, the engaging of any person as an engineer who was not furnished by the board where he sought employment, with a certificate of his being *morally and intellectually* qualified for the duty.

"If the awful consequences had not rendered the subject too solemn, we should certainly feel disposed to indulge in a little levity at the expense of that class of men so ridiculously and preposterously dubbed engineers. This is, in our estimation, a designation implying ability, study, and practical skill. Whether these qualities are usually possessed, let those decide who have had an opportunity of judging. Has it not frequently happened that men have been taken from the work bench, and, if they had barely understanding enough to oil a gudgeon, drive a wedge, or screw up a nut, have been thought adequate to a most responsible duty, on a faithful and intelligent discharge of which, depended the happiness of thousands?

"The plan proposed, or something similar, would, in our opinion, furnish a remedy for this part of the evil."

The preceding may contain nothing new, or, if new, nothing useful; if so, it will only add one to the number of idle things already written on this subject, and I must apologize for the trouble and loss of time its perusal has occasioned. In stating the fact respecting the destruction of a boiler, by the deposite of saline and other matter, I have merely intended to add one to numerous others, which lead to the belief that accidents probably arise more from carelessness and ignorance, than from any *mysterious* operations of steam. Since writing it, other similar cases have come to my knowledge, all relating to boats employed in this harbour. In these instances, which are three in number, the boilers were destroyed in a very short time by concretions on the interior. On examining one boiler, a sediment six inches thick was found. The engineer, who had the care of it, was warned of the danger, and the necessity of guarding against it, but "knew better." Another instance of injury arising from inattention, or want of knowledge, happened last summer in a boat on Connecticut river. While in operation, its movements became gradually slower, until it entirely ceased. The constructor being on board, descended to the fire room, to ascertain the cause; he turned the gauge cocks, but no water issued, and on looking into the furnace, he discovered that the whole bottom of the boiler was at nearly a white heat. Knowing what ought to be done on such an emergency, he immediately extinguished the fire, and waited until the boiler had cooled down, before he permitted water to be injected; but his *engineer*, as he acknowledged, would have

poured water into it, had there not been some obstruction in the pipes, and would no doubt have blown both boat and passengers out of existence.

Here are accidents, harmless indeed, excepting in the loss of time and money, in which the cause of injury is obvious; and, generally speaking, the cause lies no deeper than in the instances cited, wherever it has been accurately traced. A correct and satisfactory narrative of facts connected with those awfully destructive explosions which have so strongly excited the public sympathy, can rarely be obtained, nor indeed can it be reasonably expected. They who *could* give correct information, are usually placed beyond the reach of inquiry; and they who survive, and *should* know, are too much interested in palliating their own misconduct, to furnish candid representations. Our judgment, then, must be directed by those occurrences whose origin cannot be concealed, whatever motive may exist for secrecy or deception. Adopting these as our guides, the main sources of danger are readily discovered; but are not these too much neglected? Is there not, in seeking for the causes of explosions, too great a disposition to refinement? Is not scientific vanity taking the place of an unostentatious pursuit of simple truth? There appears to be an ambition to discover a supposed mysterious property or condition of steam, whose development is to be the basis of distinction and extended fame. In this spirit, a vacuum has been imagined *under* the water, and safety air valves to the *bottoms* of boilers, have been soberly recommended. Let practical science and skill be first devoted to the devising of remedies for known evils, and the imagination may afterwards flutter about at leisure in the regions of speculative theory. When the visible difficulties which encumber the surface are cleared away, there will be much less perplexity and uncertainty, in discovering and removing those which are more deeply seated.

It appears very plainly that the safety valve, as usually constructed, rarely preserves the attributes which its name imports. Instead of being so designated, it should be christened anew, and called the *Betrayer*. Not a boiler has been burst, not a boat disabled, not a limb mangled, nor a life destroyed by steam, that has not been placed under the protection of this false guardian. All its promises of security are treacherous, and the confidence which has been placed in it has been rewarded by excruciating suffering, or death. The experiments of Clement, prove that it cannot be relied upon; in vain is it urged by the raging steam, to perform the duties to which it is pledged, and to open a free passage for the escape of the destroyer. Having taken its stand, it resists all pressure, and maintains its position with a pertinacity proportioned to the force applied to drive it off. I have devised some plans which I fondly hope will be found effectual to correct this perversity of disposition, and give a more *amiable* trait of character, if possible, to this interesting appendage to the steam engine. To effect this object, it is necessary that a regular supply of water should be insured in the boiler, and this also I hope to attain. I am aware, however, that it is much more easy

to draw plans upon paper which shall have a very promising appearance, than it is to construct instruments which shall perform the duties which we may assign to them. I have, therefore, determined to adopt the wise plan of a fair practical experiment, before presenting you with diagrams of my apparatus; and should I succeed, according to my intentions and anticipations, you shall again hear from me.

R. D. H.

Boston, March 21, 1831.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Splicing a Water Wheel Shaft.

RESPECTED FRIEND,—Deeming it the duty of every one to disseminate that knowledge which experience or observation may supply, and which appears calculated to conduce to the prosperity of the arts and manufactures of our country, we send the following notice of an expedient to which we have resorted, in repairing the shaft of a water wheel, leaving thee at liberty to make such use of it as may appear best.

Having occasion to renew one of our water wheel shafts, last summer, and desirous of avoiding the great difficulty and expense attending the procuring and fixing a piece of timber of sufficient length, the idea of splicing it occurred to us, as, upon examination, the water end appeared to be perfectly sound. We procured a short piece of timber, and coupled it to the sound part by means of a gudgeon and sleeve, and have found it to answer the purpose well, with a very trifling increase of the friction. The advantage of this plan is, that of procuring a short shaft instead of a long one; which may be again replaced, as the wet end will last for a very long period, whilst the other will not be so subject to the dry rot.

With respect,

J. & S. P. GILPIN.

Triadelphia, Montgomery county, Maryland, April 2, 1831.

Remarks on some erroneous statements made by Mr. J. Shaw, in his "Observations on a Patent obtained by Lieutenant Bell, for a Percussion Lock."

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

IN the Journal for February last, there is an article, communicated by Joshua Shaw, relating to percussion locks for cannon, which contains imputations of a highly dishonourable character upon the conduct of Lieutenant W. H. Bell, of the United States army. The facts alleged in that article, are, in substance, that Lieut. Bell, by insidious means, obtained the particulars of an original and important invention from Mr. Shaw, the inventor; and, that he afterwards

endeavoured to appropriate the credit of this invention to himself, by obtaining a patent for it, as an original discovery of his own.

These are serious charges, and the article states that they can be sustained by the "most unimpeachable evidence." If they could be thus sustained before a competent tribunal, it would cost Lieut. Bell his commission, and consign his character to irretrievable disgrace and infamy.

Lieut. Bell is well known to many of the distinguished officers of the army and navy. He belongs to a profession which tolerates no dishonourable conduct in any of its members; and those who know him, believe him to be utterly incapable of the baseness with which he is charged before the public, in the Journal. He is now absent, at a remote station, where he may not, for a long time, meet with these foul aspersions on his character. It is, therefore, the duty of a friend, to whom all the material facts of the case are known, to lay a brief statement of them before the readers of the Journal.

Lieut. Bell applied to Mr. Shaw, as a manufacturer of percussion primers, to procure a number of these articles made according to a particular pattern, but which he did not obtain. This occasion was certainly the *first*, and, it is believed, the *only one*, on which Lieut. Bell ever saw Mr. Shaw. The interview occurred on the 18th day of April, 1829. This date is stated on the written authority of Mr. Shaw himself, recorded on that day.

The instrument for which Lieut. Bell has obtained a patent, was made and applied in the manner described in his specification, on, or before, the 13th of October, 1828, more than seven months prior to the interview with Mr. Shaw. The merits of the instrument were successfully demonstrated on that day; and the trial of it was continued on subsequent days, for several weeks, and until it had fired a cannon one thousand times, when the instrument remained in good order for further service. These facts are recorded in official documents, which were received and placed among the public records of the war department, in November, 1828. And the same facts were made known to Mr. Shaw, at the interview which he has undertaken to describe; the very time at which, as he now asserts, he imparted to Lieut. Bell the information which enabled him to construct the instrument; but which, as is now proved, had been made and tried a thousand times, more than half a year before. It is left with Mr. Shaw to reconcile these dates and facts, with the assertions and insinuations which are contained in the article to which his name is affixed in the Journal.

It is also alleged in the article referred to, that the instrument for which Lieut. Bell has obtained a patent, "is not in any essential particular, different from one patented on the 24th of October, 1828," by Mr. Shaw. Few persons would be able to discover the points of resemblance between them, or to point out the parts which are common to both, either in form or arrangement. But without undertaking to describe either, it is proper to point out *one* particular in which they differ; and which any other person than the author of the article quoted, would be apt to regard as *material* at least, if

not essential. It is this: when the instruments are applied to fulfil the purposes for which both are alike designed, the one never fails, the other never succeeds.

Three of Lieut. Bell's locks, have been applied to different kinds of cannon, embracing the largest and the smallest used in the military service. They have fired these cannon about two thousand times, and many hundred times in succession, without a single failure, leaving all the locks in perfect order for continued service. These facts are recorded in official documents.

Of Mr. Shaw's locks some hundreds have been made for the public service. To what extent they may have been tried, may not be accurately known to the writer. But in all the trials which have been made, and officially recorded, it does not appear that any one of them ever made more than *four* fires, without being destroyed. The repeated failures of these locks, have, as is well known to the patentee, destroyed all confidence in them on the part of the experienced officers of the public service. It would be difficult to find any one who has witnessed the trials, who would permit one of them to be put on a gun, with which he was about to face an enemy. And it may be inferred that the patentee has himself abandoned them, as he has, very recently, presented a very different contrivance for effecting the same purpose.

It would appear that Mr. Shaw claims the merit of discovering the *principles* of the application of the percussion locks and primers, to the firing of cannon. It is a matter of official record, that this principle was communicated to him by another, more than eight years ago.

The writer is aware, that topics of this nature can possess very little interest in the estimation of the readers of the Journal. But as its pages have been made the medium of a wanton assault upon the character of an honourable man who is absent, it is but an act of justice to an injured individual, that these remarks should appear in the same journal, and it is on this ground that their insertion is solicited.

As the writer has no ambition to parade his name before the public, in matters of this sort, he does not annex it. It is, however, at the service of any one who may feel aggrieved by what he has stated. JUSTICE.

Washington, April 26, 1831.

FRANKLIN INSTITUTE.

Quarterly Meeting.

THE twenty-ninth Quarterly Meeting of the Institute was held at their Hall, on Thursday, April 21st, 1831.

THOMAS FLETCHER, Vice President, presided, and

Mr. ALEXANDER FERGUSON was appointed Rec. Sec'ry, *pro tem.*

The minutes of the last quarterly meeting were read and approved.

The quarterly report of the Board of Managers was read and accepted, when, on motion, it was referred to the committee on publications, with instructions to publish such parts as they may deem expedient.

The quarterly report of the Treasurer was read and accepted.

(Extract from minutes.)

THOS. FLETCHER, *Vice President.*

ALEXR. FERGUSON, *Recording Secretary, pro tem.*

Twenty-ninth Quarterly Report of the Board of Managers of the Franklin Institute, to the Institute.

THE Board of Managers entrusted with the administration of the affairs of the Franklin Institute, for the year 1831, in compliance with the salutary custom established by their predecessors, present the following report of their proceedings in the first quarter of their term of service. The cardinal interests of the society have been, as usual, placed in the charge of standing committees, and those objects which were deemed sufficiently important to merit the attention of the Institute, have been continued under the care of the select committees appointed by the former Board. The courses of instruction in Chemistry, Natural Philosophy, Mechanics, and Drawing, for the session of 1830 and 31, have been completed, and the Board have great satisfaction in announcing, that this department continues to receive from the members a cordial and gratifying support. The attendance of a class of 60 pupils upon the instructions of the teachers of drawing, and the orderly and correct deportment of the students, confirm the Board in their high opinion of the merits of the instructers in this important branch of education for practical mechanics, and warrant them in the indulgence of pleasing anticipations of the increased skill and ability which the rising generation of workmen will display in the production of those objects, which contribute to the wealth, the independence, and the comfort of the community. The regular lectures on chemistry, and natural philosophy, and mechanics, have been attended by numerous and highly respectable classes of both sexes, and the deep attention with which the demonstrations of the professors have been received, furnishes conclusive testimony in favour of the continuance and extension of this department. For this purpose, the committee of instruction now has under consideration, the expediency of establishing a professorship of practical mechanics, and we would especially call upon the members of the Institute not to suffer a proposition, fraught with such manifest advantage, to be postponed or abandoned for the want of pecuniary means to carry it into operation.

We are indebted to Mr. A. Miller, J. R. Leib, Esq. and Mr. A. Crease, for many valuable volunteer lectures, bearing upon the interests of useful knowledge and scientific acquirements, for which the warm acknowledgments of the Board of Managers have been presented to those gentlemen. The high character which the practical men of Philadelphia have for skill in their professions and

general intelligence, should operate to bring them before the public in the character of lecturers; and the importance of correct views to the young mechanic, will, we trust, call into the field, in the session of 1831–32, a numerous corps of practical volunteers, who, despising the profit of retaining in secret the experience which they possess, will render it of double value by sharing it with the public.

The Board, deeply impressed with the benefits which have hitherto attended the exhibition of American manufactures, held under the auspices of the Institute, directed the early attention of the committee on premiums and exhibitions to that subject, and in conformity with their favourable report of the expediency of holding one in the fall of the present year, have caused an address to the manufacturers of the United States, with a list of premiums, to be published, and the committee are now actively engaged in the necessary preliminary operations which are requisite to a successful completion of the wishes of the Board. It is hoped that a very early appointment of the committee of arrangement, and the exertions of competent agents in the large manufacturing districts of the Union, will insure, at the next exhibition to be held by the Institute, an unrivalled display of our domestic products, and confirm the Board in the opinion, that honorary rewards offer a powerful stimulus to bring into operation the skill and ingenuity of our fellow-citizens. For this exhibition, the Board respectfully claim the cordial co-operation of the members of the Institute, in contributing to its embellishment, as well as in disseminating its plan in the extended circle of their acquaintance. The library and reading room continue in beneficial operation, and are regularly attended by a numerous portion of the members of the Institute. The importance of these departments demand considerable enlargement, but the limited pecuniary means at the disposal of the Board, prevents as large an appropriation to the committee on the library to improve and extend their usefulness, as is desired. Our main reliance for the gradual extension of these important auxiliaries, is in the known liberality of our fellow-citizens, from whom, donations to these objects are frequently placed at the disposal of the Board. The committee on minerals are now actively engaged in classifying and arranging, in a scientific manner, the collection of minerals now in our cabinet. They are aided in their labours by Mr. Jacob Pierce, whose valuable assistance in rendering this department useful, merits the highest eulogium. The Board have to regret that the professional engagements of their committee on models, have hitherto prevented their attention to the classification and arrangement of the models, now belonging to the Institute. We have reason to believe that the exertions of the members directed to the increase of the cabinet of models, would result in an enlarged and valuable collection of objects, teeming with instruction to our mechanics, and tending to prevent, in a great degree, the lavish expenditures of money, time, and industry, in the formation of machines which have already been successfully put in operation by the ingenious men of our country.

The committee charged with investigating the value of water as

a moving power, have brought the experiments connected with the main question to a conclusion, and a part of their valuable report will appear in the March number of the Journal, which is now on the eve of publication. A course of experiments on adjutages has been commenced under the auspices of the same committee, and is now almost completed—the public will be put in possession of the result as soon as practicable. To the gentlemen composing this committee, the thanks of the community are justly due; and the Board appeal with confidence to the members of the Institute and the public, to relieve the committee from the pecuniary responsibility under which they rest, for the payment of the excess of their expenditures above the amount received in subscriptions. The experiments on the causes of explosion in the boilers of steam engines, and the means which may tend to prevent so frequent an occurrence of these evils, are now progressing, and much valuable information has been placed in the hands of the committee. The apparatus intended for direct proof of the theories upon these subjects, is in a state of forwardness which will insure the publication of the results from actual trial, immediately after the report of the committee on water power has been printed. The Board have to announce the loss of the valuable services of Messrs. Thomas Loud and John Wiegand, as managers of the Institute; the vacancies have been filled by the election of Messrs. George Fox and George W. Tryon. In concluding this report, the Board cannot refrain from expressing the high gratification which they feel in the present flourishing condition of the Institute, and the only regret which mingles with this feeling, is caused by the limited participation of the mechanics and manufacturers of our city, in an institution which offers to their acceptance the riches of science in all its varied departments, at a yearly cost far below the weekly expenditures of many on mere sensual gratifications. We call upon them by that consideration which usually brings into action all the best energies of man, his own interest, to come forward and enrol themselves as members of the Franklin Institute, and as ardent, efficient, and free fellow labourers in the field which is cultivated by this institution, to exhibit to the world that our complete independence is caused as much by the beneficial communication of mutual knowledge, as by the freedom of our civil constitutions.

Saml. J. Robbins, *Chairman, P. T.*

Wm. Hamilton, *Actuary.*

Monthly Meeting.

The stated monthly meeting of the Institute was held at their Hall, on Thursday evening, April 27th, 1831.

Mr. C. C. Haven, was appointed chairman, P. T.

The minutes of the last meeting were read and approved.

The following donations were presented to the Institute, viz.

By Chs. Babbage, Esq., of London.
Reflections on the Decline of Science in England, and on some of its causes.
An Address to the Labourers, on the subject of Destroying Machinery.
By John Gilmore, Esq.
Congressional Directory for the Second Session.
By the Newark Mechanics' Association.
An Address delivered before the Association, by Professor John Griscom.
By Jas. J. Barclay, Esq.
First and Second Annual Reports of the Inspectors of the Eastern Penitentiary of Pennsylvania.
Remarks on the Expediency of Abolishing the Punishment of Death.
By Jas. R. Leib, Esq.
A Lecture on Scientific Education, delivered before the Institute.
By Geo. W. Smith, Esq.
Arguments in favour of the proposed Canal round the Western Abutment of the Schuylkill Permanent Bridge.
By R. C. Winship.
Ouvres Diverses, 1685.
Fourteen Numbers Casket.
Twenty do. Ariel.
Fifty do. Souvenir.
By Messrs. Carey & Lea.
Reports on Locomotive and Fixed Engines; with an account of the Liverpool and Manchester Railway.
By Mr. James Ronaldson.
Seybert's Statistical Annals of the United States.
Memoirs of the Life and Writings of B. Franklin, 6 *vols.*
An Account of the Louisville City School, with the Ordinances of the City Councils, and the Regulations of the Board of Trustees for the Government of the Institution.
Thirteenth Annual Report of the Controllers of the Public Schools for the First School District of the State of Pennsylvania, with their Accounts.
By Professor A. D. Bache.
Sur les Machines á vapeur et sur les Explosions des Machines, á vapeur, par M. Arago.
By Professor Franklin Bache.
Report of Moncure Robinson, Esq. and Col. S. H. Long, Engineers, appointed by the Canal Commissioners for examining the different Routes for Crossing the Alleghany Mountains; Read in Senate, 14th March, 1831.
An Introductory Lecture on Political Economy, delivered at Nassau Hall, Jan. 31, 1831, *by Professor Vethake.*
Third Report of the Oneida Institute of Science and Industry.
By Provost Wm. H. De Lancey, D. D.
A Charge addressed to the Graduates in Medicine, of the Uni-

versity of Pennsylvania, by himself, at the Public Commence ment, held March 24, 1831.

By Professor W. R. Johnson.

A Lecture on the Importance of Linear Drawing, and on the Method of Teaching the Art.

Some Observations on the Electrical Characters of Caoutchouc.

By Col. S. H. Long.

Report to the Canal Commissioners in Reply to Strictures, passed by Mr. Robinson, on the Views entertained by Lieut. Col. Long in relation to the Manner of Crossing the Alleghany Mountains by means of a Rail-Road.

The corresponding secretary laid on the table the following works, received in exchange for the Journal of the Institute.

London Journal of Arts and Sciences, for January, February, and March.

The Mechanics' Magazine, for December, January, and February.

The Repertory of Patent Inventions, for January, February and March.

The Register of Arts and Journal of Patent Inventions, for January, February and March.

The Journal of the Royal Institution of Great Britain, for February.

Recueil Industriel, for June and September.

Bibliothéque Physico-economique, for November and December.

Annales de Chimie et de Physique, for August and September.

Journal Universel des Sciences Médicales, No. 175.

Journal Universel et Hebdomedaire de Medecine et de Chirurgie, Vol. 1. *No.* 1 *to* 12.

Bulletin de la Societé d'Encouragement pour l'Industrie Nationale, for September.

Annales de l'Industrie Francaise et estranger, for June, July and August.

North American Review, for April.

American Annals of Education, for March and April.

Journal of the Philadelphia College of Pharmacy, for April.

Magazine of Useful and Entertaining Knowledge, for February.

The American Quarterly Review, for March.

The Ladies' Book, for March and April.

The American Journal of Arts and Sciences, for January.

The subject appointed as the topic of discussion for this evening being called up, some remarks were made; after which it was continued as the subject for the next meeting, and the following was also appointed for the same evening, viz.

What are the best means of securing the boilers, cylinders, and all other parts of steam engines, whether employed for stationary purposes, for navigation, or for locomotive carriages, against loss of heat by radiation and conduction?

C. C. Haven, *Chairman.*

J. H. Bulkley, *Recording Secretary.*

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN JANUARY, 1831.

With Remarks and Exemplifications, by the Editor.

1. For a mode of *Saving Water in Water Power;* Aaron Foot, Williamstown, Berkshire county, Massachusetts, January 4.

The patentee tells us that he claims the "applying to useful purposes, that momentum which water retains after passing from the principal, or common water wheel."

This it is proposed to do by applying a second water wheel, to be operated on by this *waste* water. The two wheels are to be geared together, by the intervention of cog wheels. The secondary wheel is to run more slowly than the principal, in the supposed proportion of the power of the two.

We recollect a similar project having been patented two or three years ago; and some of the water wheels which are in use, certainly appear as though they might be aided by such an appendage; we, however, are decidedly of opinion that in all well constructed wheels, it would be a waste of power to attempt to gain any from the waste water; and no one will commend the plan of constructing a main wheel badly, for the sake of applying a secondary.

If there is more *momentum* in the water, after it leaves the wheel, than is necessary to carry itself off, the structure is bad; and if there is not, the secondary wheel may do much harm, but cannot be productive of any good.

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2. For a *Vertical Tooth Extractor;* Ira W. Rutherford, Albany, Albany county, New York, January 4.

Numerous vertical extractors have been made, and every dentist of any eminence has tried them. There are cases in which they may be used with advantage, but so far as our information goes, those who have possessed the best instruments of the kind, have rarely employed them. In by far the greatest number of instances, a well constructed key, skilfully used, is the best. The extractor now proposed is ingeniously contrived, but although it differs in the construction of some of its parts from others made with the same intention, its general operation is the same. The tooth is to be embraced between claws, which are wedged together by forcing a piece between their upper ends by means of a thumb screw, on the main shaft of the instrument. A piece of India rubber, of soft wood, or of some other suitable substance, rests upon a sound tooth, or teeth, to operate as a fulcrum.

The patentee says, that "the advantages which it has over a newly mounted instrument, is, that it combines the lateral motion with the perpendicular." We do not know to what newly mounted instrument he alludes, but, whatever the individual may be, there are more than a dozen others variously constructed, and the question,

of superiority, therefore, does not lie between it and one other instrument only, but between it and a number of competitors.

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3. For an improvement in the *mode of adjusting metallic plates to artificial teeth;* Thos. R. Vanderslice, city of Philadelphia, January 5.

Instead of applying a metallic plate on the back part of the artificial tooth, in the usual manner, the tooth is to be moulded with a groove in the back part of it, into which the metallic plate will fit, and where it is to be secured by riveting or soldering to platina wires laid in their proper places in the groove at the time of forming the tooth.

There is to be a strip of bone, ivory, or other hard substance used to form the groove in moulding the tooth, and this is to be drilled to receive the wires. Neither this, or the manner of forming the groove, is represented by drawings, which certainly might have been done. We have repeatedly quoted the words of the patent law relating to this point, "and *shall* accompany the whole with drawings and written references, whenever the nature of the case *admits* of drawings."

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4. For a *Furnace for generating Steam for Culinary Purposes;* Jesse Reed, Marshfield, Plymouth county, Massachusetts, January 5.

This furnace may be made of cast iron. It is to consist of two vertical, cylindrical vessels, one placed within the other, a space being left between their sides to contain water. The inner vessel is to form the fire place, the bottom of it is formed of bars, and upon them the fuel is to be placed, and is consequently surrounded by the double cylinders which contain the water. A close cover forms a steam tight connexion between these cylinders, and has in it perforations for steam pipes to lead into other vessels, and for a safety valve. Above the fire, there is a grate to sustain a kettle, or other vessel, in the manner of the common clay furnaces.

"The improvement in my said steamer, which I claim as new, consists of such additions of surrounding parts to the common clay or soap stone furnace now in use, as will enable me to arrest the portion of heat which in ordinary use, escapes through the side of the furnace, and with it to boil the water which generates the steam for the purpose before mentioned."

All this may be very intelligible to some folks, but such is not the case with us. We are at a loss to discover in what way the heat which escapes through a clay, or soap stone, furnace, is to be saved, where neither of the materials are employed; and furthermore, we apprehend, putting both clay and soap stone out of the question, that this contrivance will not be found either very convenient or useful.

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5. For an improvement in *Thrashing Machines* for thrashing all kinds of chaff grain; Isaac Norton, Saratoga, Saratoga county, New York, January 6.

The beaters are to be placed upon four arms instead of upon a cylinder. The feeding apron is to be of slats of wood, the teeth are to be square and tapering, and from three-fourths to two inches long. There is to be a hollow segment supported by springs, and means are to be adopted for giving motion to the moving parts. There is no claim to novelty; the beaters, the wooden apron, the teeth, the segment, &c. being all very old, we, therefore, greet and dismiss them with all the veneration which their antiquity inspires.

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6. For an improvement in the *manufacturing of Ropes;* Edward S. Townsend and Philo Durfee, Palmyra, Wayne county, New York, January 6.

(See specification.)

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7. For a *Machine for taking out stumps from land;* Abijah Gorham, Turner, Oxford county, Maine, January 7.

A wheel and axle is mounted so as to be drawn about upon truck wheels. From the middle of the axle a chain descends, which is to be fastened to the stump. Oxen are to draw upon another chain passing round the wheel, and thus the stumps are to be raised. We are not informed whether this machine is claimed wholly, or in part only; this would indicate that the patentee considers it as altogether new; but, according to information *derived from other* sources, we arrive at a very different conclusion.

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8. For *Blocks, on which Stereotype Plates can be imposed,* denominated "Stereotype Extendible Blocks;" George W. Grater, city of New York, January 7. (Assigned to Elihu White, New York.)

Instead of the separate blocks usually employed, strips of mahohogany, reduced to a proper width and thickness, are to be locked up in a common printer's chase. The same strips, under a different arrangement, serve for folio, quarto, octavo, 12mo. or 18mo. pages. Six of the strips are to be about three inches wide, and six to be about three-quarters of an inch. Upon these latter are the proper hooks, or clasps, for retaining the plates. The particular construction of these strips and clasps are shown in drawings which accompany the specification. The wider, are called major, and the narrower, minor blocks. The claims are, to the particular plan of fashioning and arranging the blocks, so as to produce the effect intended. The using of fixed hooks attached to blocks, for the purpose explained in the specification: and the combination of the whole, in the manner set forth.

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9. For a Machine for *smoothing the bodies of Printing Type.* Invented by Stephen Sturdevant, of the city of New York; assigned to Elihu White, of the same city, and patent issued to him, January 7.

"In place of the usual mode of smoothing the type by rubbing

them under the fingers, on the flat surface of a grit-stone, I produce the same effect on them, by causing them to pass between two rotary blocks of metal, faced with steel, and having floats cut in the steel faces, to scrape the type as they pass through."

The specification refers throughout to drawings which represent the machinery in a very distinct manner, and occupy considerable space. Without a view of the machinery, the claims could not be understood; they, however, are very clearly made out.

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10. For a *Machine for casting Type,* invented by Michael D. Mann and Stephen Sturdevant, both of the city of New York; assigned to Elihu White, of the same city, and patent issued to him, January 7.

The remarks on the last patent apply with full force to the present. Judging from the drawings and description, the machine appears to have been devised with much skill; and every part of it is represented with great neatness and precision.

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11. For an improvement in *Frames for Cotton Gins;* Ebenezer A. Lester, Boston, Massachusetts, January 8.

This patent is taken for making the frames of cotton gins, in whole or in part, of cast iron. The claim is to the "making of the two ends of the frame of cast iron, whether the said ends be connected together by girders and sills of wood or metal."

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12. For an improvement in the *construction of Boats,* whether propelled by steam or other power; Nathan Cushman and Isaac Loomis, Whitehall, Washington county, New York, January 8.

A channel is to be made in the boat from stem to stern, to allow a free passage to the water; and in this channel the paddle wheel is to work. There is to be an inclined plane running from the bow of the boat, back to the wheel, and crossing the channel in which the wheel runs. This is to form a flume, up which the water is to rise, and from which it is to act upon the wheel. Such appears to be the intention, so far as we can understand the description. But as reference is made, throughout, to a model, and this part is not represented in the drawing, we are left to guess upon this point. It is altogether irregular to make any such reference, to a model; and to depend upon it, as in the present instance, would be likely to avoid the patent, as of this a model makes no part. The drawing is imperfect and inadequate, not exhibiting the parts described, or having any written references. There is no claim; and it is manifest that the patentee does not depend upon the inclined plane, as he tells us that the boat may be used either with or without it; all that is then left, to rest the patent upon, is the channel along the middle of the boat, which is a well known contrivance, having been long, and repeatedly used.

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13. For an improved *Portable Grist Mill;* Henry Weed, Sandwich, Stafford county, New Hampshire, January 10.

The stones are proposed to be much larger than in most of the portable mills recently patented; say thirty inches in diameter. A frame is to be made to support the stones, at the lower part of which frame there is to be a bridge tree, which is to be raised by a screw. The lower mill-stone is to be fastened on a spindle, and the upper is to be fixed upon the frame, with ears, screws, and nuts, to adjust it. Through the top stone there is an eye, as usual, for the feed. An iron bar crosses this stone over the middle of the eye, and receives the upper end of the spindle. The bar has springs to it to allow it a little play.

The claim is to the above arrangement, with the nether mill-stone running instead of the upper; the mode of adjusting the upper stone; the supplying the weight of stone by the bridge tree, and the bar and spring to sustain the upper end of the spindle.

Without inquiring into the originality of the other parts, we may observe that the running of the lower mill-stone has been more than once patented, and that the claim to this, therefore, must fail entirely.

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14. For an *improvement in Distilling;* John Cairou, city of New York, January 10.

This apparatus is intended to produce highly rectified spirit at one operation. The vapour, as it rises from the still, passes through successive receivers, like kettles placed upon each other. The portion which is condensed in each dropping through a tube back into the vessel below it. After escaping from these, the vapour passes through a horizontal worm; each coil of this worm has a tube leading down from its lower part, into a common tube, to conduct that portion of the spirit off, which is less highly rectified than that which passes through the worm; this latter is finally condensed in the usual way. The parts intended to be claimed appear to be those which allow of the escape of the less pure spirit in its progress towards the final condensing tub.

This patent refers, throughout, to a model; a fault into which patentees, for want of better information, are very apt to fall. We have noticed this in No. 12.

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15. For a Machine for *edging and drawing Steel Points for Carriage Springs;* George Stoudinger, Newark, Essex county, New Jersey, January 11.

A female die is to be formed, consisting of a steel roller, running as a flatting mill roller, and hollowed out in such a way as to suit the point to be drawn. Below this roller is a bed, which advances upon a carriage, as the roller turns. The platform of this bed has an inclination given to it, which is regulated by means of screws, in order to adjust it to the degree of taper to be given to the point. There is no claim; but as we believe the mode of drawing the points by means of the inclined plane, to be new, the machine itself may, in that case, be considered as altogether so, this being its essential

feature. The plan proposed appears to be not only more easy of execution, but much preferable in practice to the use of eccentric rollers.

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16. For a *Thrashing Machine;* Samuel Turner, Aurelius, Cayuga county, New York, January 11.

This machine has a cylinder, and bed, with teeth, in the usual way. The teeth are to be of wrought iron, and are to stand out about two inches. They are to be tapering, being about three-quarters of an inch wide at bottom, and one-quarter at top, placed in such a manner as to escape those in the bed, and leave proper space between them as they pass. The claim is to the formation and structure of the spikes, or teeth; their position in the bed and cylinder, and the lining of the bed with band irons.

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17. For a Machine for *Thrashing Grain, and Dressing Flax and Hemp;* Stephen J. Gold, Cornwall, Litchfield county, Connecticut, January 11.

In this machine there are several pairs of beaters, or tumblers, between which the grain, or hemp, is to pass successively. Whirls of different sizes are used to drive them, and they are thus caused to move with different velocities. The claim is to "several pairs of beaters or tumblers in the machine, one pair moving faster than another; and the combination, viz. the grain, hemp, and flax machine."

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18. For an improvement in the common *Tin Baker;* Gordin Williston, New London county, Connecticut, January 11.

This baker is to stand before the fire, and is in fact what is commonly called a tin kitchen. The lower part is to be made to reflect heat upwards, as the upper part does downwards.

"What I claim as new, and as my invention, and nothing else, is simply the substitution of the reflecting surface in the lower part of the pan, instead of the box for coal as in the baker in common use. Making thus the 'Double Reflecting Baker.'"

We do not understand the description given, and cannot, therefore, point out the merits of this invention.

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19. For an improvement in the *Mode of Curing Tobacco;* Tyre G. Newbold, Franklin county, Virginia, January 11.

The improvement proposed is, "after having a tight house in which the new cut tobacco is to be hung, build a furnace at a convenient distance from the walls of said house, and have a funnel extending on the ground from said furnace through the house, and turning back discharge the flame and smoke in the open air, at a convenient distance from the building. The furnace and funnel to be made of brick, stone, or other incombustible material." This comprises the main point of the specification, and we much mistake if the

claim of the patentee, to be the true and original inventor or discoverer, will prove to be an undisputed one.

There is no drawing of the furnace and funnel; objects which certainly might be drawn, and a representation of which would undoubtedly aid those who wish to carry the plan into operation.

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20. For an improved mode of making *Harrows for the purpose of Agriculture*, called the "Revolving Harrow;" Samuel Rugg, Lancaster, Worcester county, Massachusetts, January 11. (See specification.)

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21. For the *Application of Water to Mill Wheels;* which the inventor calls "the Syphon Principle, or Artificial Pressure;" William Kendall, Fairfield, Somerset county, Maine, January 12.

The specification of this patent is drawn up with great labour; it includes many numerical calculations, and an essay upon the application of water in mills of different kinds. From the course pursued it would be extremely difficult to give an analysis or epitome of this paper; we will, however, make one or two quotations, which may perhaps afford a general idea of the proposed plan. The wheel is a kind of tub wheel, with the buckets secured between two rims, with the shaft connected to one of them.

"The wheels which I have constructed and applied to my invention, have buckets, as it were, at right angles with the former wheels, and lie thus \\\\\. The water may seem to act upon it by pressure from the whole of the head, but it is only by reaction that the wheel moves. This wheel which I have constructed for ease in making, and permanency of its parts, may represent at a glancing view, that which was formerly called a tub wheel, except it has no arms, the buckets entering the shaft, and are supported in the rim; they are very flat, and very thin; their edges which cut and leave the water are made sharp. By their obliquity they scarp or lap over each other, and the space between them all is called the throat, or opening of the wheel; they decline about three or four inches to a foot of their width. For a wheel of four feet diameter, with seven buckets, their width becomes about fifteen inches at the shaft, and two feet at the rim. This rim then requires to be about ten and a half inches deep, so as to extend one inch below the buckets, and two inches above, for passing a feather edged bar of iron through with its thick edge resting against, and fair with, the buckets, as a cutter; one end being driven well into the shaft, the other end bent down and supported under a hoop, which binds the rim and wheel," &c.

The specification, of which we have copied a very minute part, thus concludes: "Thus have I endeavoured to explain the principles and how to use this invention, where an additional artificial pressure is applied to the wheel, increasing its effects by suction, which I call the syphon principle, where the force of the percussion of water, as well as gravity, is applied to repel the atmospheric pressure, which I claim as my invention when applied to mill wheels. Also the

wheel and parts for applying the same according to this my specification."

We confess that we do not understand the reference to the atmospheric pressure, and the syphon principle, although we have carefully read the parts in which they are described; but the description is an involved one, and we could not take the time to make it a study, without a fair prospect of learning something from it. The drawing which accompanies the specification, lends little or no aid to the description, being very indifferently executed.

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22. For an improvement in the *Manufacture of Buttons*, called the Safe Eye Button; Charles Goodyear, Philadelphia, Pennsylvania, January 12.

This patent is taken for enclosing pieces of cloth, leather, or other substances which can be penetrated by a needle, between plates of metal. These plates have a hole of one-quarter of an inch diameter punched in them, to serve as an eye through which the sewing is to be effected.

"The improvement which the said Charles Goodyear claims consists in the manner of fastening between the shells, the cloth, leather, catgut, or substance to be sewn through, and in making the eye of the button of cloth, leather, catgut, or other substance of a similar form, leaving holes, and thereby obviating the objection to most buttons which are liable to cut the thread with which they are fastened on clothes."

The specification describes the formation of the plates or shells, and the manner of uniting them; but these are not represented by drawings, which ought to have been done.

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23. For an *Instrument for the Teaching of Geography;* Elizabeth Oram, city of New York, January 12.

As this instrument is the invention of a lady, we will, of course, allow her to tell her story in her own way, without any animadversions of ours, which might mar the narrative, or involve us in inextricable difficulties.

"Be it known, that I, Elizabeth Oram, of the city of New York, have invented a new and useful instrument for the teaching of geography, and that the following is a full and exact description of the construction and use thereof as invented by me.

"It consists of a globe, upon which the surface of the earth is represented by various heights, as they exist in nature. By this the distinction between land and water is clearly seen. The various ranges of mountains, with their relative heights exhibited; and their influence upon heat and productions, with their geological structure.

"By means of a magnet inserted in the surface of the improved globe, the great principle of attraction may be clearly shown, by affixing thereto any small iron figure.

"This globe is surrounded by the principal circles of the sphere. The ecliptic is elevated, by means of which, and a moveable and

illuminated sun, the manner in which the earth receives its rays, and the causes of seasons, may be clearly exhibited. On the horizon there is affixed a small instrument, by which the causes of eclipses are shown.

"A moveable star, brings to the comprehension of pupils the nature of right ascension, declination, celestial latitude and longitude."

ELIZABETH ORAM.

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24. For an improvement on the *Bar Share Plough;* Edmund M. Waggenet, Adair county, Kentucky, January 12.

We have no doubt that the plough described is a very good one, but its appearance is much like that of many other ploughs; and although the patentee has placed it before us with much care, he has not told us in what his invention consists; he has, however, mentioned some of its good properties, and we will repeat after him, that "The plough is adapted to work with or without a coulter, and designed for fallowing, ridging, and ditching farm lands; draining marshes; turnpiking roads, and repairing highways."

"The projective slope of the bar and share gives to the plough a descending draft, which causes it to draw to and retain its hold in the earth to the depth regulated or required. The rolling board and face of the share forming a regular circle, and passing on at near right angles, *rolls, beds,* and *pulverizes* the earth at one and the same time. Placing the surface soil to the depth the plough runs, and bringing the clay, or sub-soil, upon the surface. All parts of the plough which are pressed by the earth being metallic, immediately scours smooth, cuts, slides, and rolls off the earth without friction or compression, which renders the draft extremely light; and from the combination of its parts, is rendered the more permanent by a hard draft."

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25. For an improvement in the *Percussion Lock for Cannon;* Enoch Hidden, city of New York, January 14.

In its general features this lock bears a strong resemblance to that patented by Mr. Joshua Shaw, of Philadelphia; but to lessen the powerful reaction upon the cock, or hammer, from the explosion, by which it is liable to be broken, that part of it which is immediately over the vent, has a hole drilled in it, to allow the explosion from the touch hole to pass through it. It has also a preventive spring, placed near the head of the cock, to ease it off in its recoil.

The claims are, the opening in the head of the cock; the mode of making the cock, as described in the specification; the preventive spring; a small steel or other metal tube to contract the vent hole; a piece of metal with leather or sponge, to place on the priming to keep it dry, or to close the vent when the gun is sponged, &c.

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26. For sawing boards by means of a *Double Toothed Saw;* Stafford Dawly, Annsville, Oneida county, New York, January 14.

At p. 10, (No. 70 in the list,) we gave a description of a saw with double teeth to saw timber by the moving of the carriage in either direction.

The present patent is obtained for the same thing precisely, and furnishes an example of what is perpetually occurring at the patent office. There is scarcely an instance in which any thing is patented which has the slightest air of novelty, that several do not claim to be the original and true inventors. We are aware that priority in the date of a patent is no evidence whatever of priority of invention. The real inventor is in general anxious to test the goodness of his plan, and whilst doing so, some of the numerous patent pirates with which many parts of our country are infested, catch the idea, and to those in this trade, an oath presents no obstacle to the attainment of their ends.

We know nothing about who is the inventor of the double saw; perhaps he has not yet come forward, and therefore our remarks are not at all individual in their character. Nor are they now made in consequence of the intrinsic merit of the present plan, as we think lightly of it on several accounts. The timber must be sawed entirely off at every cut, which in many instances cannot be done. The carriage has its bearing changed when its motion is reversed, and the boards will, in consequence, be sawed with less truth; and the teeth at each edge of the saw must be set equally open, and those which are not cutting will injure the face of the timber.

Three or four unmeaning lines constitute all that can be called a drawing in this patent; the object it is true can be well understood without a drawing, but the law claims one, and admits of no discretion on the subject.

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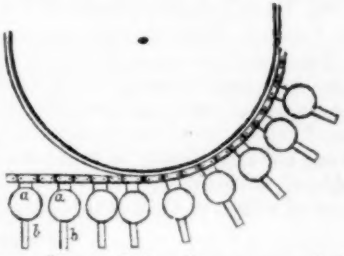
27. For improvements in *Navigation, and in the application of Steam, Men, Animals, or other Natural Agents, thereto;* William W. Van Loan, city of New York, January 15.

The essential feature of this plan is the passing of an endless chain of paddles over drums, in order to operate upon the water, in place of the ordinary paddle wheel. In this, taken simply, there is nothing new; but there are some particulars in which the plan proposed lays claim to originality.



The drums over which the endless chain passes are to be air tight, hollow cylinders, and each of the paddles, or keels, as they are called in the specification, is attached to a buoyant, hollow, water-tight vessel, running its whole length. In the accompanying sketch, the ends of the chain of paddles are shown passing round one of the drums, *a*, *a*, being the air-tight vessels, and *b*, *b*, the keels, or paddles.

The patentee says that, "in order to the more clear and full understanding of my invention, I further declare and set forth, that it rests upon the following principles."

"1st. In substituting for the paddle wheels, or other usual propelling apparatus, an endless chain of empty water-tight vessels, made to revolve upon appropriate drums or wheels, by steam, or any other prime mover whatever."

"2nd. In substituting for the buoyancy of the hull of a boat, or ship, the buoyancy of the immersed part of the endless chain of vessels, or when necessary, of hollow drums, or cylinders, or prisms, and the carrying forward any load they may bear, free from any resistance but that which they themselves experience. By these means getting wholly rid of the rapidly increasing resistance that fluids present to motion through them. I retain only a resistance whose measure is independent of velocity, and have thus in my power, theoretically, to obtain unlimited velocities: and, in practice, velocities limited only by the power of the prime mover that may be applied to the apparatus."

It is proposed to apply the same principle of buoyancy to the paddle wheels of team and steamboats, as an additional security against their foundering.

The whole description is written with much judgment and talent, but from what we know, and have seen, of attempts to propel vessels by endless chains of paddles, we anticipate no advantage from this part of the plan, when the test of practice is applied to it.

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28. For an improvement in the manufacture of *Saddles;* Levi Sherman, Bridgeport, Fairfield county, Connecticut, January 18.

In this saddle, nailing is substituted for sewing. The straining of the web, &c. is effected in the usual manner. The seat is drawn over and nailed fast. The skirts are nailed to the side bars.

Sometimes the skirts, or jockey, are made to meet in the centre of the saddle, and are seamed or stitched together; then stitched or seamed from one side bar to the other, and the skirts nailed on the side bars around the bellies of the saddle. The claim is to "the mode of making saddles by nailing instead of sewing the seams."

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29. For an improvement in the *Reaction Wheel;* John Turner, Augusta, Kennebeck county, Maine, January 18.

This patent is taken for an arrangement which is essentially the same with that claimed by Calvin Wing, the specification of whose patent was given in our February number, page 86. In the present specification the whole is imperfectly described; the part which Mr. Wing calls the *lighter* is here mentioned, and we are told that "this mode of relieving the wheel from the weight of the incumbent column of water, is what is specifically claimed as my invention."

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30. For *Stiffening Wool and Fur Hats and Caps* by the

use of India rubber, &c.; Laban L. Macomber, Gardiner, Kennebeck county, Maine, January 19.

(See specification.)

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31. Machine for *Planting Onion Seed, all kinds of Garden Seed, Beans, Corn, &c.;* Peter Smith, of Chatham, and Theodore H. Arnold, of Haddam, Middlesex county, Connecticut, January 20.

This machine is to be driven forward like a wheelbarrow; it has two wheels united by a cylindrical shaft. Above this shaft two hoppers are placed to contain the seed; the cylindrical shaft fits against and closes the lower part of the hoppers; holes are bored in the shaft to form chambers, or receptacles for the seed, and they are to be larger or smaller according to the kind of seed to be sown. The hoppers may be more or less numerous; and the cylinder also may be varied. The claim is to "the arrangement and putting together of the various parts in the way and manner described, and the application of said machine in the form and method above described for the purpose of planting seeds."

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32. For a mode of *applying the propelling power of water, steam, or any other known power, to mills or machinery;* Jehiel W. Dart, and Willard Webster, Truxton, Courtland county, New York, January 21.

The patent under the above title, is for one of those futile and worthless contrivances which are by no means rare in the records of patented inventions. That others may judge on this point as well as ourselves, we give the whole specification.

"Make a water wheel of a smaller diameter than the fly or balance wheel to be hereafter described. On the same shaft place a drum, pulley, or cog wheel, of the same diameter as the wheel first mentioned, or it may be larger or smaller. Make another wheel of a larger diameter than those before mentioned; and let it be connected by straps, belts, or cogs, to the last mentioned wheel. Let the gearing intended to be applied to mills or machinery work in this last mentioned large wheel, or into another wheel placed on the same shaft with it, and of the same size; or it may be larger or smaller as may be deemed most proper.

"The *invention* here claimed, and desired to be secured by letters patent, is the arrangement of the wheels as above described, by which the power originally applied to a small wheel, is communicated to mills or machinery by the intervention of another wheel or pulley, giving motion to a larger wheel."

JEHIEL W. DORT,
WILLARD WEBSTER.

Comment is entirely out of the question.

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33. For a *Furnace for Heating Tyre;* Dudley Marvin, Canandaigua, Ontario county, New York, January 21.

The furnace is constructed in the form of a circular trough, usually of cast iron, formed in segments, the inner rim of the trough is small enough to admit the tire of the fore wheel of a carriage, and the outer rim sufficiently large for the hind wheel; a hollow channel passes round under the furnace; the plate which forms the top of this channel and the bottom of the furnace, is perforated with many holes, to allow wind to pass up from the channel. A large pair of bellows supplies this channel with air; charcoal is put into the circular cavity and ignited, and the tire placed upon it. The whole hoop is thus equally and rapidly brought to a red heat. Three minutes has served for this purpose, after the furnace had become heated. The parts are well adapted to the end proposed, and in large establishments we have no doubt that it will be found eminently useful.

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34. For *Propelling Machinery;* Thomas D. Newsom, Nashville, Davidson county, Tennessee, January 22.

Although this specification is writen in English, it might, for our use, as well have been offered to our comprehension in the language of Psalmanazer. On looking at the drawings, we perceived that the intention was to propel machinery by the vibration of a pendulum; the array of levers, wheels, and pinions, however, was too formidable to admit of our seeing through the design of the patentee, without resorting to his description, but after reading this, the darkness was only rendered the more visible. We could only discover that there was to be a double rimmed draft wheel; a double winged lever; a swing lever with a circled fork; two cranks on one shaft, and one somewhere else; two pitmen; a draft wheel; a drum wheel; a chain to work round two pulleys; two lever wheels; two speed cog wheels; a pulling wheel; two purchase levers; a gearing cog wheel; a fly wheel; a scape circle; and a number of other unmentioned and unmentionable parts, all of which are in some way, we do not know how, to be animated by means of a swinging weight, or pendulum, and is then to propel *steamboats*, rail-way carriages, and all kinds of machinery. In order to do this "there must be a seat on the end of the swinging lever, on which a man places himself, having a spring attached to the end of the carriage for the rider to place his feet against, to keep up the vibrating of the lever, propelling forward the vehicle."

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35. For an improved *Knife for Cutting Tobacco;* James J. Mapes, city of New York, January 22.

The claim is as follows.

"The invention here claimed, and desired to be secured by letters patent, is the above described case or stock, with the moveable steel blade, which can be renewed when worn, from time to time; the case remaining the same; whereas in the common method the knife is made all of one piece, and when the steel is worn the whole knife must be thrown aside."

The contrivance is something like that of a double ironed plane,

that is, the cutting knives of tobacco machines are to be made to set forward by means of screws tightening them upon slats.

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36. For a machine called the *Self-regulating Conduit*, for passing water around canal locks, from a higher to a lower level; James Clark, Westmoreland county, Pennsylvania, January 25. (See specification.)

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37. For a *Bevel Wheel Plane, for Planing Boards*, &c.; Jonathan Newhall, Washington, Lincoln county, Maine, January 25.

Plane irons are fitted into the rim of a wheel, so as to cut on one face of it. Four, six, or any other number of irons may be used. The shaft of the wheel is to run in collars behind the cutting side, so as to leave the face unobstructed. The shaft has a sliding motion in the collars, to adapt it to stuff of different thicknesses. The wheel may be three feet in diameter, and its face is to be bevelled, so as to take off about half an inch on the edge, and to extend to two inches, or upwards, upon the face, according, as we suppose, to the width of the irons. The mouths of the planes may be made more or less open by means of plates of iron let in flush, but capable of sliding, so as to close the mouth when desired. These, of course, are to be tightened by suitable screws.

The timber is fixed upon a suitable carriage, and is to be moved along by a rack and pinion, or otherwise.

The claims are to "the bevel on the face of the wheel, the use of which is to admit the lumber to enter between the carriage and the verge of the wheel, and thereby present the part to be planed off to the action of the planes."

"The sliding motion of the wheel, by which various thicknesses may be planed."

"The running the lumber by the centre, and the metallic plates, the use of which is to answer the purpose of double irons, [by closing the mouths,] which principle is contemplated to be applied to hand planes."

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38. For an improvement in the common *Churn, and in the mode of working it;* Talmage Ross, Pickaway, Pickaway county, Ohio, January 26.

The dasher of the common churn is to be moved up and down by a lever, working like a pump handle. No doubt it will work.

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39. For an improvement in the *Sawing of Timber*, by water, steam, or any other power; Jeremiah Smith, Morris township, Morris county, New Jersey, January 27.

The saw frame, instead of working up and down between the fender posts, in the usual manner, moves in a curve, which the patentee terms an elliptical curve.

Two grooves are cut in each fender post, which are convex to-

wards their fronts. Projecting pieces at the upper and lower ends of the saw frame fit into these grooves, and as the frame is moved by the crank, the direction of the saw is, of course, governed by the grooves.

"The saw," the patentee says, "thus striking the timber, or log, to be sawed, first by the lower end of the saw, and by that means clearing the timber or log of saw dust, and thus removing that incumbrance from it."

"The patent is required only for the elliptical motion of the saw; the ellipsis to be varied according as it may suit the views of the applicant."

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40. For a *Rotary Pump;* Thomas Sutton, Norwich, New London county, Connecticut, January 28.

We have described several rotary pumps, and those who are conversant with hydraulic machines, are well acquainted with the principle upon which they in general operate. Toothed wheels taking into each other, or sliding valves variously constructed, are employed for the purpose of raising the water. In the present instance the sliding valves are used, and the mode in which they are moved is extremely ingenious, but a clear and adequate idea of the arrangement would require a view of the drawings. The great objection to most of these plans is a want of simplicity, which causes them to be difficult to make, and very liable to derangement by friction; we fear that these difficulties have not been overcome by the present patentee.

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41. For an improvement in the *Art of Tanning;* Osmond Cogswell, Cincinnati, Hamilton county, Ohio, January 29.

(See specification.)

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42. For a *Machine for Dressing Staves;* John G. Conser, Rebersburg, Centre county, Pennsylvania, January 31.

The stave is to be driven through an opening in a tool made of iron, or steel, the opening being of the size of the intended stave. This tool is to be fixed upon a block, and a ram, or driver, raised up by a pulley, and falling down between guides, is to force the stave endwise through the tool. The claim is to "the above machine for shaving or dressing staves."

To the judgment of the cooper, we must leave the estimation of the value of "the above machine." Were we to venture an opinion upon so recondite a subject, we should say that such a machine might reduce staves all to one width and thickness, but that it would neither straighten them, or dress them, in the technical acceptation of the term.

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43. For Machinery for *Cleaning Wool from Burs* and filth by means of Steel Combs, while the wool remains on the

skin; Lewis L. Miller, Rochester, Monroe county, New York, January 31.

A cylinder, resembling the large cylinder of a carding machine, is to have on it a number of rows of steel teeth about five-eighths of an inch in length; to this cylinder a revolving motion is to be given. A second cylinder, about a foot in diameter, is placed parallel with the former, and slides to and from it on a carriage. The skin to be cleaned is to be put upon this smaller cylinder, and fixed to it at one edge by a moveable strip. The feeding, or smaller cylinder, may be turned by means of a crank, the hand graduating it as may be necessary. The mode of using it will be obvious from the foregoing description.

"What the inventor relies on in this improvement, is in applying the combs in this way to cleaning sheep's wool from burs, cockles, and other filth common to wool, making the same article more valuable in market, at less than one-fourth of the common expense in cleaning."

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44. For a *Washing Machine;* James Hinkley, Fayette, Kennebeck county, Maine, January 31.

A curved segment, formed of rollers, and a pendulous, or vibrating, rubber adapted to them, and having spiral springs to adjust it, are to operate within a tub or trough.

The patentee tells us that, "Although rubbers and rollers of various descriptions have been entered into machines, constructed for the purpose of cleansing or washing clothes, yet, I allege that the foregoing describes a new arrangement or construction of the parts, constituting a new conformation, and producing the effect by a mode of operation entirely new, and therefore claim it as my invention."

"He must have optics good, I ween."

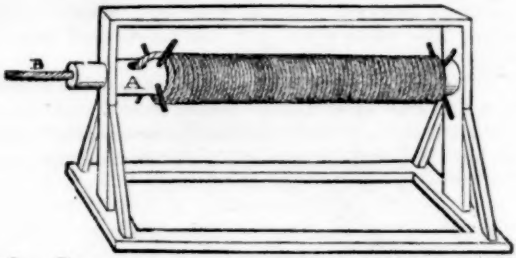
SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a patent for an improvement in the manufacturing of Ropes. Granted to EDWARD S. TOWNSEND, *and* PHILO DURFEE, *Palmyra, Wayne county, New York, January* 6, 1831.

THIS machine is composed of a shaft, or reel, used in place of a wheel or crank, to give the twist or turn for laying strands or rope; so that a strand or rope can be twisted or laid in certain lengths at a time, until a rope or strand is twisted or laid of any required length. The shaft to be fixed to revolve on proper supports, (in boxes, or gudgeons, &c.) made of proper materials, with a hole passing into the side and out at the end, so that when a rope or strand is coiled on the shaft, the end of it can pass through the eye thus made in the end of the shaft, not interfering with the supports; thus giving a chance for spinning to it another length of yarn; then the shaft being turned, gives the turn for the laying of strands or rope, which, when so laid, is again to be reeled, leaving the rope out as

before: thus on-laying, and spinning, until any required length is finished. The chief object is to make a rope of any assignable length in one piece, by laying it in portions of convenient length, and spinning into the threads of the end of such parts as is already laid. In laying several ropes into a layer, or tarred yarn into a rope, the reels or machines must be equal to the number of strands and rope, and may remain stationary, or be placed on slides, or truck wheels, as may be necessary.

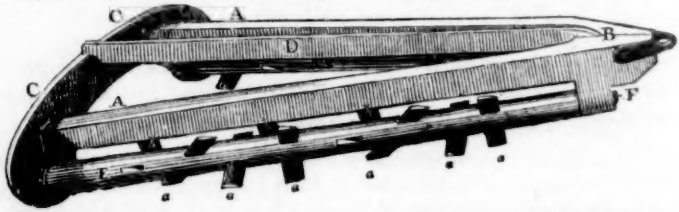
Edward S. Townsend,
Philo Durfee.



A, shaft. B, rope passing out at the end of the shaft.

Specification of a patent for an improvement in the mode of making Harrows for the purposes of agriculture, called Revolving Harrows. Granted to Samuel Rugg, *Lancaster, Worcester county, Massachusetts, January* 11, 1831.

This improvement in the harrow is more particularly described as follows, and I refer to the drawings of the same accompanying this specification, and the model deposited in the office, for a more complete and full understanding of the improvement.



In the drawing, A, A, are two horizontal bars forming a triangle, and joined at B.

B, is the forward part of the harrow.

C, C, the junctions of the bars at the other end of the frame and with A, A, and B, constituting the whole frame.

D, a brace running from B, to a middle point between C, C, and is also extended as a runner when the harrow is turned over on its back, for the purpose of being drawn over the ground without obstruction.

E, E, are two cylindrical rollers which come near together at the point F, and revolve at each end on their axes. These cylinders diverge till they reach the part of the frame C, C, where they are inserted, and may be made to constitute, at pleasure, either a greater or less angle than A, A.

a, *a*, *a*, &c. are iron teeth, part of which are visible in the drawings. These teeth are mortised into the rollers, the same number in each roller, and pass entirely through, and have sharp edges, with backs, resembling in some degree the blades of penknives, and varying in size with the size of the rollers and frame. These teeth may be grooved, or made concave on one side, or may be of plain surfaces.

b, *b*, *b*, &c. some of which are visible in the drawing, are pieces of iron inserted in A, A, and extending downward towards the rollers, for the purpose of clearing them from sods, earth, or other obstruction.

The mode in which this harrow is worked is as follows. The power is applied at the end near to B. The rollers are thus immediately put in motion, and continue revolving in opposition to each other; that is, revolving in opposite directions, and outwardly from the frame on either side. This improved harrow is very useful in cross furrowing, and particularly so in subduing rough land, and soils that are stubborn, either from roots, or otherwise; and breaks up and mellows the land with great advantage. It is also easier for draft than the common harrow of the same size.

The principle to be secured is the revolving principle as applied to the harrow. The form is of less consequence. The petitioner contemplates the use of his improved harrow in other forms; for instance, the bars A, A, may be brought nearer together than C, C, or may be entirely removed, and D only retained. E, E, may be made to diverge more or less, or work in parallel lines, and revolve either way by varying the form of the teeth; and a single roller may be used with a handle at the end opposite to the draft, for light harrowing, or cross furrowing. SAMUEL RUGG.

Specification of a patent for an improvement in the composition of Matter used in stiffening wool and fur hats and caps, by the use of Indian rubber, (elastic gum,) either in combination with gum shellac, or alone. Granted to LABAN L. MACOMBER, *Gardiner, Kennebeck county, Maine, January 19th,* 1831.

BE it known that I have invented a new and useful improvement in the composition of matter to be used in stiffening wool and fur hats and caps, by which they are rendered so elastic as to be folded into a small compass, and packed with clothes in the trunk of the traveller, or elsewhere, as convenience may require; after which they can be made to resume and keep their original shape; by using elastic gum, (Indian rubber,) either in combination with the gum

shellac, or alone. If used with shellac, I dissolve the elastic gum in spirits of turpentine, or any other suitable solvent, and the shellac in alcohol, or any other agent proper to dissolve the same. If used alone, I dissolve the elastic gum aforesaid in spirits of turpentine, or other solvent.

What I claim as my invention is, the use of gum elastic, either alone or in combination with gum shellac, as aforesaid, in stiffening wool and fur hats and caps, so as to render them elastic to such a degree that they may be folded and packed, and then restored to their usual shape aforesaid, and also to render them water proof.

LABAN L. MACOMBER.

Remarks by the Editor.—A patent was obtained in England, some years since, for applying gum elastic, in combination with shellac, and other resins, to the stiffening of hats, and rendering them water proof. We do not now think it necessary to turn to the patent; but if any one doubts the correctness of the assertion, we will do so, and, if desired, publish the specification.

Specification of a patent for a machine called the Self-regulating Conduit; for passing water around canal locks, from a higher to a lower level. Granted to JAMES CLARKE, *Westmoreland county, Pennsylvania, January* 25, 1831.

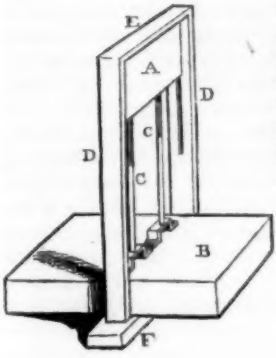
THE bottom of the conduit, connecting with the upper level of the canal, must correspond with the bottom of that level, and be carried to such a point between the upper and lower levels of the canal as shall be found most convenient for the construction of the regulating gate; the lower level of the conduit must be on a plane with the lower level of the canal, or may be sunk as much lower as the particular circumstances of the case may require. The dimensions of the conduit must be regulated in proportion to the quantity of water which it is intended to vent. At the connexion of the two levels of the conduit, the regulating gate must be placed, and constructed in the following manner.

Two, or more, mud sills are framed together, and are placed horizontally at the bottom of the lower level of the conduit, into which two upright gate posts are placed, one on each side of the conduit, and extending from the bottom of the lower to the top of the upper level; these posts to be supported by a cap sill, braces, and longitudinal frame work, covered with plank extending each side of the gate, so as to conduct the water towards the gate, and to serve as an apron to convey the water over the air box, buoy, or float. A groove or rebate must be cut in each of the gate posts, so as to receive the gate, and extending from the top of the posts downwards, a sufficient distance, to admit the top of the gate to be drawn down to the bottom of the upper level of the conduit. When the size of the gate shall be such as to prevent it sliding easily in the grooves,

or rebates, metals, boxes, or friction rollers, will be placed so as to admit a free action of the gate.

The gate must be constructed of plank well jointed and secured together, and be of a height corresponding with the greatest depth of water intended to be maintained on the upper level. This gate is connected with an air box, buoy, or float, placed in the lower level, which box, buoy, or float, must be of a size and buoyancy sufficient to raise the gate as the water shall rise in the lower level. This box, buoy, or float, is connected with the gate in the following manner. Two, or more, screws, are required with flat heads, resting on the top of the box, buoy, or float, and secured to it by metal plates, having holes in them sufficiently large to admit the shank of the screw to pass upwards through them. When these plates are fastened to the box, buoy, or float, the heads of the screws will turn under them in the manner of a swivel. Holes corresponding with the screws must be bored in the lower edge of the gate, and be of sufficient depth to admit the box, buoy, or float, and the gate to be screwed together, or apart, so as to maintain any required quantity of water on either level. Screw nuts must be placed in these holes so as to govern the gate. The screws are provided with holes in their shanks, near the box, buoy, or float, to admit the end of a turning bar or lever, for the greater convenience of working them. When it is intended to maintain a greater quantity of water on the upper than the lower level, the gate must be screwed from the box, buoy, or float; when the greater quantity is required on the lower level, the gate must be screwed towards the box, &c.—The operation of the machine will be as follows. The water, in passing the conduit, will flow over the top of the gate into the lower level; as the water rises in the lower level, the buoyancy of the box, buoy, or float, will force the gate upwards until the required quantity is obtained in the lower level, when the upper section of the conduit will be closed by the gate. Should the water sink in the lower level, the weight of the box, buoy, or float, will draw the gate downwards, so as to admit the water to pass over its upper edge, thus producing a regular supply, and such depth of water in the canal, at all times, as may be desirable.

JAMES CLARKE.



A, regulating gate.
B, air box.
C, C, screws.
D, D, gate posts.
E, cap sill.
F, mud sill.

Specification of a patent for an improvement in Tanning. Granted to Osmond Cogswell, *Cincinnati, Hamilton county, Ohio, January* 29, 1831.

The improvement consists in applying a solution of oak or other bark to hides or skins, in such manner, as that when the glutinous particles of the hide have absorbed and become mixed with the tanning, or astringent principle, the other part of the solution (viz. the water,) may pass off and leave the hide free to receive more of the solution, and so on till it is tanned. The object is to expedite the process of tanning, and consequently to diminish the amount of capital necessary to be employed in the business.

The *apparatus, and mode of application* is as follows. Make a frame of timber of a square form; the width to be made as great as the width of the hides, parts of hides, or skins, that are to be tanned; the height and length to suit convenience. Near the bottom, or ground of said frame, a tight floor is to be formed of the length and breadth of the frame; said floor to incline to one side so as to carry off the liquor after it has passed through the hide; the sides and ends to be raised from two to four inches above the floor, by fastening strips of plank on the inside of the frame; this will appear like a box; say four feet wide, two inches high on one side, and four on the other, and twenty feet long; (these boxes may be fixed one above another, about twelve inches apart to the top of the frame;) said boxes to be filled with *saw dust*, or any other soft porous substance, that will not prevent the solution from running through the hide, and at the same time absorb and carry it off after it has passed through. On this surface, (of saw dust,) the hides, sides, or skins, (after having been prepared in the usual mode for tanning, except that the flesh is to be taken off clean,) are to be smoothly spread out, and in order to keep on them a sufficient quantity of the solution, make sacks of coarse cotton or other cloth, an inch or more in diameter; fill them with the same material that the boxes are filled with, and place them around under the edges of the hides, which will raise said edges equal to the diameter of the sacks. After this is done, pour on the hides as much of the solution as the hollow surface which they will then present will hold, and continue to fill them up as it runs off through the pores of the hide, for the space of from three to fifteen days, (the time in proportion to the thickness of the hide or skin,) in which time they will be tanned, except the extreme parts or edges, which cannot be brought so fully under this process as the other parts of the hides: and in order *perfectly* to tan *them*, it is necessary to lay them in vats after the common mode, for three or four weeks.

Osmond Cogswell.

Specification of a patent for an improvement in the process of Distilling. Granted to James L. Jenks, Sacket's Harbour, New York, May 2nd, 1831.

To all whom it may concern, be it known, that I, James L. Jenks, have invented an improvement in the process of distilling, by which alcohol, or spirits of any desired proof, may be obtained at one operation, and that the following is a full and exact description of my invention, and the manner of carrying it into effect.

The separation of ardent spirits from water, or from vinous liquids, by distillation, in whatever way the process may be performed, depends upon the different degrees of heat at which these fluids are converted into vapour; and the strength of the spirit obtained, is governed by the manner in which the condensation of the vapour is effected. My invention consists in an improved construction and arrangement of the condensing apparatus, by which the whole, or nearly the whole, of the water which rises in vapour with the spirit, is condensed and returned into the still, whilst the whole, or nearly the whole, of the spirit, is subsequently condensed, and passes over into the proper recipient.

For the purpose of giving a clear view of my apparatus and mode of procedure, reference may be had to the annexed drawing. In this, A, represents the arch and still, with the usual appendages, having a boiler for the use of steam. The still, as shown, I have converted into a spirit still, by putting a stopper through the supply pipe, B, near to the supplyer, C, and inserting another pipe, a segment of which is shown at D. This pipe leads up to a reservoir from which the still may be supplied with spirit. At the bottom of the supplyer, C, there is a valve, regulated by a float in the still, an arrangement well known to those who distil by steam. The tub E, contains the ascending worm, to be presently described. This worm may vary in length and size, but it is best when made of about one hundred feet in length, and having a bore of about three inches at its lower end, and for one half of its length; and of about two inches in its upper half. F, is the ordinary condensing worm and tub; G, the recipient; H, the platform on which the tubs stand; and I, the penstock for supplying cold water, with the arms or tubes attached to it.

The beak of the still, or the tube, J, has a slight ascent, as it proceeds from the still to the ascending worm. The tub, E, is filled with water, the temperature of which I elevate to 176 degrees of Fahrenheit's scale, and sometimes higher, depending upon the strength which is intended to be given to the spirit. To heat the water in this tub, I first charge the still with water, the fire is then raised, and the vapour from the water will produce the desired effect, the heated water is then drawn off, and the still charged as usual.

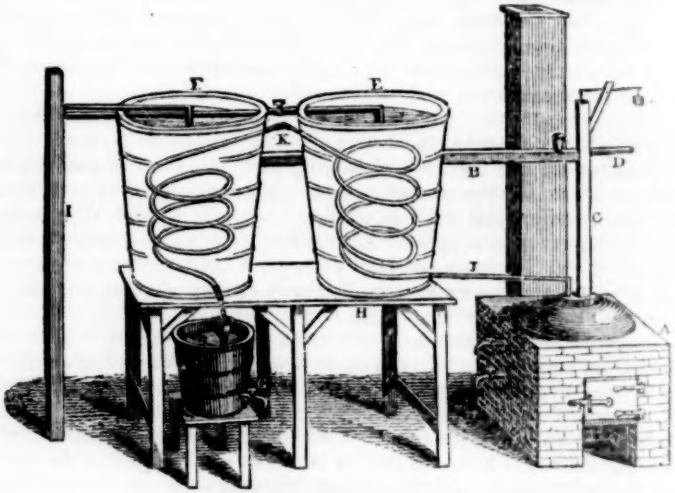
The upper end of the ascending worm, and of that in the refrige-

ratory, F, are connected together, as shown at K. The water will by this means be nearly, or entirely, separated from the spirit.

It is not absolutely necessary that the beak of the still should be connected with the *lower* end of the worm in the tub which contains heated water, as the same effect may be produced by connecting it with the *upper* end, and the connecting the lower end of this worm with the final condenser; attaching a tube at the junction of the two in such a manner as shall enable it to return the condensed water, or wash, into the still. Such an arrangement I consider the same in principle with the former.

What I claim as my invention, and for which I ask a patent, is the placing of the tempered refrigeratory, with its worm, between the still and the usual condenser, in the manner and for the purposes set forth in this specification.

JAMES L. JENKS.



Remarks by the Patentee.

It is not pretended that either time, or fuel, is economized by using steam as the prime heater, in converting spirits, already distilled, into alcohol; but, so far as regards the use of steam, my object is to enable the distiller, who already uses steam in the process of distilling the low material, to draw off his spirit as high as he pleases, at a single operation. I have made many experiments upon this point, all confirming the correctness of the principle upon which I have proceeded. The apparatus which I have in use, however, has an ascending worm of only seventy feet in length, whilst it ought to be one hundred, with a bore of only two inches. The consequence of which is, that the spirituous vapour passes over the apex, when the refrigerator is at a temperature lower than that at which spirits boil.

In an experiment made with water only, to ascertain what must be the temperature of the refrigerator to allow its vapour to pass over, not a particle was obtained until the temperature was 186°, and but a minute quantity at 196°.

When I mixed two quarts of spirit with 150 gallons of water, the spirit came over when the refrigerator stood at 170°; but owing to the small proportionate quantity of spirit, the quantity eliminated was insufficient to fill the worm, the ingress of atmospheric air, at a damp season, had, consequently, the effect to reduce it to 71 per cent. above proof, by the New York standard hydrometer.

I charged my tub with 104 gallons of proof spirit, the refrigerator standing at 164°. Spirit came over immediately after boiling. Some samples taken were 90 above, and after drawing off 45 gallons, with the refrigerator varying from 164° to 168°, the whole, when mixed, was 85 per cent above. I then changed casks, turned my temperature regulator, and allowed the refrigerator to run up, and when the remainder of the spirit was drawn off, it was 73 above.

It may be perceived, therefore, that by this simple process, alcohol is readily obtained from a very low wash, without the use of alkali, or any other agent having an affinity to the water, and that at a single operation.

Documents relating to the Royal Ordinance of France, (1823,) *concerning High Pressure Steam Engines.*

[TRANSLATED FOR THIS JOURNAL.]

[(Continued from page 279.)

Circular of the 19th of May, 1825, *to the Prefects of Departments.*

I HAD the honour to transmit to you, in conformity with the 8th art. of the ordinance of October 29th, 1823, instructions in relation to the measures of precaution to be observed in the use of high pressure engines.

Scientific questions of importance, requiring numerous and accurate experiments, and the assistance of the Academy of Sciences, were to be resolved in order to the preparation of a second set of instructions, relating to the proof to be borne by boilers, previous to their use, and to the fusible disks with which they are to be provided.

These instructions are now transmitted to you; they have been drawn up by the Board of Engineers of Mines, and of Civil Engineers, which was assembled to put in execution the ordinance of October 29th, 1823; and have been approved, May 7th, by his excellency the Minister of the Interior. I inclose — copies.

You will find, accompanying this,

1st. A table of the elastic force of steam at different temperatures, drawn up by the Academy of Sciences.

2nd. The ordinance of October 29th, 1823, in relation to high pressure engines.

As an acquaintance with these documents is indispensable to the manufacturers of high pressure boilers, and as they interest those who use the engine, I request you to send copies to both these classes of persons, so that they may not be ignorant of any of the articles to which they are obliged to conform.

The numbers in the table* referred to, are only approximate. The Academy of Sciences is of opinion that the temperatures corresponding to the elasticities, are not more than two or three degrees from the truth, even in the highest parts of the table; so that no practical inconvenience need be feared, in following the measures of precaution.

The Academy is now engaged in the experiments necessary to make this table accurate, and also to determine the dimensions which should be given to safety valves. I will communicate their results as soon as the experiments are concluded.

You know that if there is no resident engineer of mines in your department, the government civil engineer must, according to art. 7 of the ordinance, supply his place, and superintend the proving of boilers, and of their fusible plates. This engineer should visit every work, at least once a year, examine the boilers which are in use, and induce the removal of those, the use of which he may consider dangerous.

I request you to inform the makers of high pressure boilers, and those who use them, who are obliged, by the terms of the ordinance, to have boilers proved and marked, that they must apply to you, that you may direct them to the engineer who is charged with such duty, and may give, at the same time, to this engineer, the necessary instructions.

When you shall have informed me that there are works for manufacturing boilers, in your department, I will send you,

1. A die to stamp the fusible disks; also, a second die, in case of accident to the first, or to supply an adjacent arrondisement.

2. A die, having a *fleur de lys* sunk upon it, with which to mark the screws attaching the fusible plates to the boiler. (There will also be a second die of the same kind.)

These dies will be placed in the keeping of the engineer.

I send you three models of each die. One of them will be deposited in the archives of your department, the others will be sent to the engineer charged with the inspection of boilers.

If more of the articles sent are wanted, for the different arrondisements of your department, I will send a further supply, upon your requisition.

You will not forget that the 7th art. requires of the local police, a constant surveillance of the works where high pressure engines are used.

In case of an infringement of the ordinance, the proprietors of the works will be liable to their stoppage, without prejudice to the penalties which may be awarded by the courts.

* The use of this table having been superseded by the publication of one, drawn from the recent experiments of Arago and Dulong, it is not appended to this translation.—[Translator.

It is your duty, Mr. Prefect, to make such arrangements for this surveillance as may seem most proper to you. Human life depends upon the observance of the ordinance and instructions, which have the further object of securing manufacturers from serious losses.

I request you to see to the execution of the rules prescribed by the ordinance and instructions, and to acknowledge the receipt of these.

(Signed,) BECQUEY.
Counsellor of State, &c.

Second Set of Instructions in relation to the execution of the Royal Ordinance of October 29th, 1823, concerning High Pressure Engines.

THE royal ordinance of the 29th October, 1823, requires that no boiler shall be sold, much less used, until it has been provided with two safety valves, and two disks of fusible metal, and also has been proved by the hydraulic press, and marked after the proof.

Those makers of high pressure boilers who may have boilers to be proved, will inform the Prefect of the same, who will transmit the information to the engineer of mines, residing in the department, or else to the government civil engineer, who is to supply his place. (Art. 7 of the Ordinance.)

The Prefect will take care that these operations, relating to the proof, are conducted with as little delay as possible, that no inconvenience may result from them to the arts. The engineer will ascertain, first, if the safety valves are of the proper dimensions. He will ascertain also, if the apertures to be covered by the fusible plates are of the proper sizes; that is, if one has a diameter at least equal to that of one of the safety valves, and the other at least twice this diameter. He will further satisfy himself that the position of these plates is such that they will fulfil their object.

The boiler will not be proved until after the fusible plates are applied. The fastening of the plates to the boiler will be preceded by the operations now to be described. The engineer must determine from the table hereunto annexed, the degree of the thermometer at which the metallic plate to be used, must fuse. He will next ascertain whether the metal proposed to be employed has the requisite fusibility; this may be verified in two ways.

1st. If the metal has been prepared by the maker of the boiler, the engineer will proceed to determine the temperature at which each of the ingots to be employed will fuse, using the apparatus employed by the maker for the purpose, if he is satisfied of its accuracy.

2nd. If the metal is that used in commerce, the engineer will merely satisfy himself that it bears the legal stamp designating its fusibility, which has been affixed, by the engineer of mines intrusted with making such trials, in the manufactory of the metal: this stamp will be of the kind spoken of in the next paragraph.

The engineer, having ascertained that the alloys, of which the plates are to be made, fuse, at 18° F. and 36° F., respectively, above the temperature of the steam of ordinary working pressure, will have

the two disks cast in his presence, and will place upon each an octagonal stamp with the motto, "Civil Engineers of Mines;" and in the middle of this stamp he will have, immediately, engraved the degree of fusibility of the disks. The disks will then be fixed upon the boiler.

If the maker of the boiler shall have procured disks already tried and stamped, the engineer will have no other trouble than to examine the stamps, indicating their fusing points, before having them affixed to the boiler.*

The engineer should attend to the fact that he is not in search of the precise temperature at which the plates fuse, but of that at which the plate becomes so soft as to yield to pressure. This distinction is important, because the plates of fusible metal lose their tenacity before they melt. The stamp should therefore denote, not the temperature of perfect fusion, but that which softens the metal so much that it will give way to a pressure corresponding to this temperature.†

The boiler tubes having been attached to the boiler, as well as the fusible plates and the safety valves, (duly loaded,) the boiler must be filled with water, and proved by means of a forcing pump, or of a hydraulic press, to be furnished by the manufacturer, who shall also provide the labour necessary to its use.

The proof pressure must be five times that at which the engine, to which the boiler belongs, is to be worked; for example, if the boiler is to contain steam of two atmospheres, the proof pressure must be carried to ten atmospheres.

When the boiler may have resisted such a pressure, the engineer shall have it marked, in his presence, with the number showing in atmospheres the pressure under which the boiler is to be worked.

The apparatus for marking shall consist, first, of a circular plate of copper, struck at the mint of Paris, bearing an inscription, *Ordinance of October 29th*, 1823; upon this the number of atmospheres and half atmospheres, shall be marked; 2nd, of three screws, of the same metal, intended to fasten the plate to the boiler. After the screws have been inserted and tightened, the engineer shall have the head of each cut off even with the plate, so as to erase the groove on the head. He shall then have a fleur de lys stamped upon each head by a die larger than the head itself.

The plate and screws shall be furnished by the manufacturer.‡

By means of the method just described, all high pressure boilers will be proved where they are manufactured, which will confine the proving to a few departments.

If there is no manufactory of boilers in a department, the duties of the engineer, in relation to boilers, introduced into the depart-

* Manufacturers will find fusible metal, prepared according to the directions of M. Gay Lussac, Member of the Royal Academy of Sciences, at the store of M. Collardeau, &c.

† In this paragraph, the great advantage of the fusible plate over the safety valve, viz. that it yields by the effect of temperature, and not of pressure, seems to have been lost sight of: to have followed such a direction to the letter, would have been to reduce the efficacy of the plate most materially, by depriving it of the power of guarding against the explosions resulting from a defective supply of water within the boiler.—[Trans.

‡ Manufacturers may procure them, at cost, at the Royal Medallic Mint, &c.

ment, either for the use of high pressure engines already licensed, or which may hereafter be licensed, will be limited to ascertaining that they have the two proper marks. This can easily be done by means of the models.

One of these models is deposited in the Archives of the Prefecture, the other in the office of the Engineer of Mines, or in that of the Government Civil Engineer.

(Signed,) Becquey, *Counsellor of State, &c.*

Approved.

(Signed,) Corbiere, *Minister of the Interior.*

Paris, May 7th, 1825.

On the first invention of Telescopes, collected from the notes and papers of the late Professor Van Swinden. *By* Dr. G. Moll, *of Utrecht.*

The late Professor Van Swinden had been at considerable pains to illustrate some important points in the history of natural philosophy. The first invention of telescopes in Holland attracted a considerable share of his attention, and he had the good fortune to meet with some official documents, which are calculated to throw some light on the mystery in which the early history of this celebrated invention is involved.

Mr. Van Swinden exposed the result of his labours in several public lectures, and he intended to publish a paper on the subject: his death prevented the accomplishment of this purpose. He left, however, the sketches of his lectures, together with extensive notes, and abstracts from various writers, which he had collected with great industry. These papers were committed to my hands, and the result of what I collected from them has been ordered to be printed by the Royal Institute of the Netherlands.

The little which is known of the first invention of telescopes in this country has been principally derived from two sources: first, from the book, which the French physician, Pierre Borel, wrote on the subject in 1655, probably at the request, and certainly with the assistance, of William Borel, at that time ambassador of the States at the court of France.* The second source from which information is generally derived, is a passage in Descartes's Dioptrics,† in which he attributes the invention to a citizen of Alkmar, called James Metiús. Both the versions of Borel and Descartes are usually given in books written on this part of natural philosophy, and very

* De vero Telescopii inventore, cum brevi omnium Conspicilliorum historia, authore Petro Borello, Regis Christianissimi consiliario et medico ordinario; Hagæ Commit. ex typogr. Adriana Vlacq. 4to. 1655. Pierre Borel was a native of Chartres, and author of several other books: he died 1689. A copy of this very rare tract has been recently added to the library of the Royal Institution. It contains a portrait of Lippershey.

† Cartesii Dioptrica, p. 49.

recently they were repeated in the very excellent account of the life of Galileo, published in England, and in the still more recent and capital work of Professor Littrow on Dioptrics.

The real name of this Metiús of whom Descartes speaks, and who is also mentioned by Huygens, was Jacob Adriaansz. His father Adriaan Anthonisz was a man of considerable knowledge for his time; he possessed a great influence, and took a principal part in the struggle with Spain. In consequence, he was banished by the Duke of Alva, and his property confiscated. He contributed very essentially to the glorious defence of his native town against the Spaniards in 1592. He was created afterwards inspector of fortifications, and many towns were fortified on his plans. As a mathematician he is celebrated for his expression of the ratio of the diameter and circumference of the circle, by the numbers 113 and 355. At that time Ludolf van Ceulen had not given his celebrated number, and the ratio of Archimedes, of 7 and 22, was in general use. The numbers of Anthonisz have the merit of being easily kept in memory, and of being as accurate as almost any purpose requires. If no logarithms are used, it is easier to calculate than Ludolf's number.

There is another problem remaining of this Anthonisz, which shows his ability as a mathematician: it is recorded in one of the writings of his son Adrian, and Delambre notices it in his history of astronomy. The problem was solved by Nicholas des Muliers of Bruges, then professor of mathematics in Groningen.

All the four sons of Adriaan Anthonisz were mathematicians like their father. The eldest, Dirk or Theodore, was an engineer and surveyor in the service of the States. He sailed in that capacity in the expedition against the Spanish colonies in the West Indies and the coast of Africa, sent out under Admiral Peter Van der Does in 1599. He died in that ill-fated expedition.

The second son, Adrian, whilst at the University, had the nickname of *Metiús* given to him by his fellow students, on account of his propensity to mathematics. He became generally known under that name, and wore it through life. His father sent him to Hueen to study astronomy under the celebrated Tycho, and afterwards he visited several universities of Germany. He filled the astronomical chair at the university of Franeker with great credit, and died in that place in 1635. His works were very numerous and celebrated in their time, being considered the best elementary works then extant. Delambre seems to have known only one of Metiús' books, of which a complete catalogue is to be found in Vriemoet.*

The fourth son, Anthony, did not rise to such extensive fame: however, he also served his country as an engineer.

The third son is the person whom Descartes designates as the inventor of the telescope. His name was Jacob Adriaansz; and sometimes the name of Metiús, which properly belonged to his brother, was given to him. This Jacob or James, died between 1624 and 1631. Contemporary writers describe him as a person of eccentric and fanciful habits, buried incessantly in deep meditations, and of a temper so little communicative that he very seldom spoke to

*Athenæ Frisiacæ.

any one about the subject of his studies. It is well known that such an eccentric turn of mind is not incompatible with mechanical genius, and in England and elsewhere the most consummate skill has often been blended with most singular habits. It appears, from the evidence of writers of that time, that this Jacob had acquired considerable skill in working glass, and excelled, amongst other things, in the construction of large burning lenses. It is said that he once placed a large lens on the walls of Alkmar, and predicted that at a certain hour of the day it would set fire to a tree standing at a great distance on the other side of the moat. At the request of Prince Maurice of Nassau, who was a great proficient in mechanics and mathematics, many and pressing solicitations were made to make Jacob explain how this, and other apparatus which he contrived, were executed; but he obstinately rejected all offers, and always refused to give the least information, even on his death-bed, when strongly urged by a clergyman, at the request of his relatives. It must be allowed that at that time, and even now, the construction of a burning lens of such power was a matter of great difficulty, and even at present very few artists would be capable of doing the same. So strong was his desire to conceal his inventions, that before his death he caused his apparatus and tools to be destroyed.

This eccentric character sent a petition to the States General of the United Provinces, dated 17th of October, 1608. An original copy of this document, made by a public notary in the most authentic form, is existing in the library of the university of Leyden, amongst the manuscripts of Huygens. In this document it is distinctly asserted that this person actually invented the telescope. He calls himself Jacob Adriaanszoon, son of Mr. Adriaan Anthoniszoon, and he goes on to state, "that since two years, he employed all the time which he could spare in inquiring into some occult or secret arts connected with glass making. That he found that, by means of a certain instrument which he was making for another purpose, the sight of persons using it might be extended, so as to make objects which, on account of their distance, could not be seen or only distinguished with great difficulty, appear near and distinct. That since that time he applied himself to bring this invention to greater perfection, in which he succeeded so far as to make an object appear as visible and distinct by his instrument as can be done with *that which was lately offered to the States by a citizen and spectacle-maker of Middleburg.* That his excellency, (Prince Maurice,) and others who compared the instruments, convinced themselves of this fact, notwithstanding that his instrument was made of only coarse materials, and merely for the sake of experiment. That he has no doubt but that the contrivance, by improving the engine, might be brought to greater perfection, but that, besides, he believes and hopes to improve, in time, *the invention in itself,* so as to make it capable of doing great service. That he apprehends that, in the meantime, other persons might imitate his invention, building on the foundations which he had laid, by the grace of God, with his *ingenuity, great labour, and intense study,* and by these means might frustrate

him, and rob him of the fruits of this invention, which he has a right to expect with great confidence; and therefore, he prays their High Mightinesses to grant him a privilege (*octroi,*) by which every one, *not possessing the said invention at present*, is prohibited from imitating this instrument, or even from selling or purchasing instruments made contrary to this privilege, without his express leave, and on a fine of a hundred florins on each instrument; and that this privilege is to last twenty years, or, instead of a privilege, to allow him such a remuneration as will be adequate to the utility and service likely to be derived from this invention."

In the margin of the petition the following appointment is written: "The petitioner is exhorted to make further investigations, to bring his invention to greater perfection; when his prayer for a privilege will be taken into consideration."

"*Actum*, 17 *October*, 1608."

With the signature of "Aersens," the then Secretary of the States.

If we are disposed to give full credit to Adriaanszoon, whom, for brevity sake, we will call *Metiús* in future, it appears that he began the researches which led him to the invention of the telescope as far back as 1606; that the invention was due to chance, and occurred while its author was trying other experiments; that he spent subsequently much time and labour upon it; but that in 1608, when he sent in his petition, his instrument was made of bad materials, and might be much improved. At the same time he readily admits that another person, *a spectacle-maker of Middleburg*, had offered before him a similar instrument to the States, which had been tried by Prince Maurice and other persons, and he gives us to understand that his instrument is equal to that of his competitor. Nothing is said which enables us to judge of the performance of either instrument.

Mr. Van Swinden examined the written Acts and Journals of the States General of that time with great care. These papers are kept at present among the state archives in the Hague. Under the date of the 2nd October, 1608, the following entry is made:—

"*Jovis*, 2 *October*, 1608.

"On the petition of *Hans Lippershey*, a native of Wesel, an inhabitant of Middleburg, spectacle-maker, inventor of an instrument for seeing at a distance, as was proved to the States, praying that the said instrument might be kept secret, and that a privilege for thirty years might be granted to him, by which every body might be prohibited from imitating these instruments; or else to grant him an annual pension, in order to enable him to make these instruments for the utility of this country alone, without selling any to foreign kings or princes. It was resolved, that some of the Assembly do form a committee, which shall communicate with this petitioner about his said invention, and inquire of him whether it would not be possible to improve upon it, *so as to enable one to look through it with both eyes;* and further, to inquire what remuneration would satisfy him. And due report being made, it will be laid in delibera-

tion, whether it is expedient to grant to the petitioner a remuneration or a privilege."

From this document it appears who this inventor was, whom Metius designates in his petition of the 17th of October, and whom he allows to have anticipated him in presenting a telescope to the States: it was the spectacle-maker of Middleburg, born at Wesel, and called Hans, *i. e.* John Lippershey. This man offers to keep his invention a secret; and he intimates a belief that it might be of service. This story offers also a ludicrous instance of the strange vexations to which ingenious men must often submit, from ignorant but official persons; this is—

> "The insolence of office, and the spurns
> That patient merit from the unworthy takes."

Here comes Lippershey, tendering to the States an invention, which, in its further progress, is entirely to alter and to extend all our notions of the universe—an invention which bodes a complete revolution in navigation and astronomy, and the first thing which these wise men think of, is to lay the inventor under the obligation of making a telescope through which *one could see with two eyes.*

Two days afterwards, the 4th of October, 1608, we find the following entry upon the Journals of the States:—

"*Sabathi*, 4 *October*, 1608.

"Resolved, that inclusive of the communication held the 2nd instant with Hans Lippershey, a native of Wesel, inventor of the instrument to see at a distance, one person from each province will be named, to examine and to try the said instrument on the turret of the mansion of his Excellency (Prince Maurice,) and to investigate whether it is likely to be of such utility as is generally believed; and, in such a case, to treat with the inventor, that he undertakes to make three such instruments of *rock-crystal*, (*christael de roche*,) for which he asks a thousand florins a-piece; that he moderates his charge, and promises never to transmit his invention to anybody."

In this piece we have the counterpart of what happened to Galileo at Venice. Here we have the members of the States-General ascending the turret on Prince Maurice's house, to examine a distant object with the newly invented spy-glass, as the Venetian senators mounted the steeple of St. Mark; and probably Lippershey was equally tired as the Italian philosopher, with showing off his instrument to persons requiring telescopes to make them see with two eyes.

The mention which, in this early stage of the invention, is made of rock or mountain crystal, appears very curious. It seems that in this beginning, the difficulty of procuring glass fit for telescopes was equally as great as it is now, and *rock* crystal was frequently resorted to in the construction of object-glasses. This appears, among others, from a passage in Hevelius, who, however, gives the preference to glass. At this present day the Parisian optician, Cauchoix, constructs telescopes of rock or mountain crystal, which he calls *lunettes vitro-crystallines*; but which, in my opinion, are

inferior to glass telescopes of equal size. One consequence may be deduced from the circumstance of rock-crystal being used in the construction of these telescopes, which is, that this spectacle-maker must have been well skilled in his profession, inasmuch as it is much more difficult to work and to select crystal than glass.

The 6th of October following, mention is made again in the Acts of the States, of the subject of telescopes:—

"*Lunæ*, 6 *October*, 1608.

"The commissioners of the Provinces who have examined the instrument made by John Lippershey, spectacle-maker, and who have communicated with him, report that the instrument is likely to be of utility to the state, and that in consequence, they offered to the inventor to make such an instrument of rock-crystal for the state, at the price of three hundred florins, payable immediately, and six hundred florins more when the instrument is completed and approved of. Resolved, to authorize these gentlemen, as is done by the present, to come to a final conclusion with Lippershey, about the making of the said instrument, and to limit him a time within which the instrument is to be completed and delivered in good order. And then the States are to deliberate whether a privilege or an annual pension is to be granted to the petitioner, under condition, that he will promise to make no such instruments, but with the consent of the States."

Whilst these transactions were taking place with Lippershey, Metiús, the second competitor, handed in his petition the 17th of October. Having gone so far with Lippershey, the States were perhaps at a loss how to dispose of Metiús's claim. They contented themselves with giving him some empty words of encouragement, and some vague promises for the future. After this time nothing more was done by Metiús to attract public notice. He doggedly refused to show his telescopes to anybody, not even to Prince Maurice, and least of all to his brother, the Professor of Franeker. Perhaps Jacob Metiús was disgusted with the little encouragement he received, and it is not unnatural to suppose, that a man of his eccentric habits, having once failed in his object, could not make up his mind to make a second attempt.

The petition of Metiús appears, however, to have had some influence on the manner in which the petition of Lippershey was disposed of.

We next find the following notes on the Record Book of the States-General:—

"*Jovis*, 11*th December*, 1608.

"The petition is read of Hans Lippershey, spectacle-maker, inventor of a certain instrument for seeing distant objects: no resolution has been taken on it, but Messrs. Van Dordt, Magnús, and Vander Aa, are appointed to speak with the petitioner about the said invention."

"*Lunæ*, 15*th December*, 1608.

"Messrs. Magnús and Vermanne report, in the absence of Messrs.

Vander Aa, and Boeles, that they examined the instrument invented by the spectacle-maker, Lippershey, to see at a distance *with two eyes*, and that they approved of it; in consequence of which it was proposed whether the privilege ought to be granted to the said Lippershey, of making alone the said instrument for a certain number of years, and to pay him the remaining six hundred florins which were promised him for the said instrument. Resolved, that whereas it appears *that many other persons have a knowledge of this new invention*, to see at a distance, it is expedient to refuse the prayer of the petitioner for an exclusive privilege, but that he will be commanded to make, within a certain time, two other instruments of his invention, for seeing with two eyes, for the same price; and checks are to be despatched to him for three hundred florins, and when the instruments are completed, of six hundred florins."

Lippershey used no delay in making the instruments, thus setting an example which the most eminent in his profession are said not to have always followed. The next mention is made of Lippershey in February, 1609.

"*Veneris*, 13*th February*, 1609.

"Hans Lippershey delivered the two instruments for seeing at a distance, which he was ordered to make, and in consequence it has been resolved to despatch checks of the three hundred florins remaining of the nine hundred which were promised him for three of the said instruments."

From these documents it appears that both Lippershey and Metius failed in their attempt of obtaining an exclusive privilege. But certainly the instruments of the former were liberally paid for. Nine hundred florins, or 75*l.*, for an instrument such as it can be expected to have been at that time, is certainly a high price; and even at the present time a very respectable telescope could be obtained for that money. From this circumstance we would be rather inclined to argue, that these instruments were not so roughly made as Italian authors, and those who follow them, are willing to persuade us. Our thrifty forefathers were too prudent and too economical to throw away considerable sums of the public money on things of bad manufacture and rough making.

Italian writers generally represent the Dutch telescopes as very imperfect. But how do these writers know this? Has Nelli, or any other, ever seen one of the telescopes of that time? If not, how can they judge of their performance? There is not the least necessity, in order to value the transcendent genius of a Galileo at its proper standard, to depreciate the merit of others; and we may admire Galileo without being unjust towards his contemporaries.

It is very remarkable that the absurd wish of the States to have an instrument which would enable them to see with two eyes, should have led to the invention of an instrument which has at present fallen into undeserved oblivion. It appears from the official documents, that Lippershey indeed gratified the wishes of the States, and that he produced an instrument with which they could see with two eyes. There can be little doubt but that this instrument was what was

called afterwards *a binoculus*. The invention of this instrument is generally attributed to the Capuchin friar, Rheita,* who describes it in one of the most singular books which ever were written. For terrestrial objects a well arranged binoculus is perhaps the most pleasant telescope, but some dexterity is wanted to bring it to proper adjustment. It shows the objects considerably brighter and more distinct than a common telescope of equal power; and it has the great advantage of not straining and fatiguing the eye.

The readiness with which Lippershey furnished the States with the binoculus is a proof of considerable ingenuity, and must tend to do away with the notion that he was a low, ignorant mechanic, guided by mere chance.

The States, refusing to grant the privilege which Lippershey wished to obtain, gave as a reason of their refusal that the invention was *known to many*. Of this we have evidence in Metiús's petition; but we may find some more, in a book from which one would little expect to draw scientific information.

Negotiations, which terminated in a twelve years' truce, were then pending in the Hague, between the States and Spain. The ministers of the king of France, Henry IV. were the celebrated President de Jeannin and Monsieur Bussi. The letters which Jeannin wrote on the subjects of these negotiations to the king and his ministers have been printed, and amongst them we find something relating to the history of the invention of telescopes.†

Thus on the 28th of December, 1608, a few days after the States had refused the privilege to Lippershey, Jeannin and Bussi write to the king.

"The bearer, who returns to France, is a soldier of Sedan, who served some time in Prince Maurice's company.‡ He possesses several inventions for the war, and that form of glasses [the French has *lunettes*] which have recently been invented in this country by a spectacle-maker of Middleburg, by which one sees at a great distance. The States ordered the workman, who is the inventor of them, to make two for your majesty. We should not have required their favour, if the artist had been willing to make them at our own request; but he refused, saying, that he had express orders from the States, not to make them for any body. We will send them to your majesty on the first opportunity; and notwithstanding this soldier makes them as well (*aussi-bien*) as the other, as appears by the trials which he made, still the difficulty of making them is not great."

The same day the President writes to the minister Sully:

"The bearer of this letter is a soldier from Sedan, who belongs to the prince's company, and who is held very ingenious in many inventions and artifices of the war. He has also made, a few days

* Oculus Enoch et Eliæ, sive Radius sidereo-mysticus planetarum, Antwerpiæ, 1645, fol. p. 348, 354. See also Dioptrique Oculaire par le Pére Cherubin Le Gentil, Memoires de l'Academie des Sciences, 1778. Smith's Optics, p. 974.

† Lettres et Négotiations du Président de Jeannin. Paris, fol. 1656.

‡ In the Prince's guards.

ago, an engine, (*un engin,*) in imitation of that which has been made by the spectacle-maker of Middleburg, to see at a distance. He will show it to you, *and make you some for your sight.* I requested the first inventor to make me two, one for the king, and one for you; but the States prohibited him from making any but for themselves. They ordered some themselves to give them to me, that I may send them to you, which I will do the first day."

The king's reply is very remarkable, being written about a year before that prince was murdered at the instigation of the Jesuitical faction. He writes thus the 8th of January, 1609:

"I shall see with pleasure the glasses which you mention in your letter, though at present I am more in want of such that can show me things near me, than of those which show distant objects."

Having thus shown what are the respective claims of Metiús and Lippershey, we must now consider those of a third pretender to the honour of the invention. This person was also a spectacle-maker of Middleburg, called Zacharias Tansz, and he has, more generally than Lippershey, been considered as the original inventor. The information of what we know about him must be wholly derived from Borel's book on the invention of telescopes. William Borel, who appears to have been very anxious about this matter, being himself a native of Middleburg, had all the persons then living, and knowing something on the subject, examined before the magistrates in 1655. Their depositions are given in Borel's book; but the originals of these depositions have not been found in the records of the town of Middleburg, although a very diligent search was made for them. In these documents, the places and houses in which both Lippershey and Zacharias Tansz lived, are frequently mentioned. These houses have since been taken down, and an open space now occupies the place where the telescope was invented.

Some of the witnesses, whose evidence is given in Borel's book, are in favour of Lippershey, and some in that of Zacharias. We must now carefully sift that evidence, and compare it with what Borel says on the subject, in a letter to Pierre Borel.

The first witness who occurs on the list is John Williams, a steward or beadle. He is seventy years of age, in 1655, and knew Laprey personally when he made spectacles. Afterwards he made telescopes, (*tubos longos,*) which he did about fifty years, when Laprey offered the first telescope to Prince Maurice, as he (the witness) heard at the time.

This witness brought the invention down to 1605, but he does not appear to have had a very clear recollection of the exact time of the invention.

The second witness is Edwold Kien. He is a messenger, aged sixty-seven; says that the man who made the telescopes was John Laprey, of Wesel; that he began making telescopes about 1610, and died in October, 1619. He (the witness) married the daughter of this Laprey. Laprey offered to Prince Maurice and to the States some of his telescopes, for which he got a reward, and a privilege for three years. He adds, that the sign of the house where Laprey lived was a *telescope.*

From a comparison of dates, it is obvious that this witness is mistaken, and that Lippershey made telescopes, and offered them to the States, long before 1610.

The third witness is a blacksmith of the name of Abraham Junius, aged, in 1655, seventy-seven. He says, that the name of the man who first made telescopes in this town was Hans, *i. e.* John, but that he did not observe the surname; that this man was commonly called John the spectacle-maker; that about forty-five or forty-six years ago this John made the first long telescopes; (*conspillia longa;*) that the witness knew him long ago, before he made spectacles, when he was a bricklayer; he assisted at the funeral of John; he knows, and heard very often, that John made long tubes (*tubos longos*) and telescopes for the use of Prince Maurice.

This witness brings the invention to 1609 or 1610, and very little is to be concluded from his evidence.

The Capuchin Friar, Rheita,* attributes also the first invention to Lippershey, whom he calls Lippensum. This is certainly no great alteration of the original name, not greater than that which is made by the English author of the Life of Galileo, who chooses to translate Borel's name into Italian, and calls him *Borelli*. According to the version of Rheita, the invention dates from 1609, when Lippershey happened to place a convex before a concave, and discovered, by chance, that the weathercock of a neighbouring church, and other objects, were magnified. He placed his glasses in a tube, and amused the visiters of his shop by showing them the weather-cock magnified, and larger than it could be seen with the unassisted eye. The Marquess of Spinola, happening to be at the Hague at the time, to negociate about the truce, saw this new instrument, bought it, and gave it to the Archduke Albert of Austria, the Spanish Governor of Belgium.

In the mean time persons of high station (*proceres*) heard of the circumstance, and that other similar instruments had been constructed by the maker. The inventor was forced to sell his instrument for a great price; but he was prohibited from making or selling any more of them. In this manner, says the worthy friar, this noble and capital invention would have remained in obscurity, and hidden perhaps for ever, if it had not been transferred, by the will of God, to the court of Brussels, and made known there.

The Capuchin friar is mistaken in the dates, bringing the invention to 1609 instead of 1608. But besides, the Marquess of Spinola was not at the Hague in 1609. He left that city the 30th of September, 1608, together with the other Spanish ministers. That he left the Hague a little before Lippershey presented his petition to the States; but the Marquess, residing at the Hague, certainly could not see an apparatus which a spectacle-maker had erected in his shop at Middleburg; but, at all events, there is a possibility that Spinola, residing at the Hague in September, 1608, heard of the invention, and procured a telescope for the Archduke.

[to be continued.]

* Oculus Enoch and Eliæ, p. 337.

The nature and properties of the Sugar-Cane, with practical directions for the improvement of its culture, and the manufacture of its products.—By George Richardson Porter.

The author of the volume before us, informs us in his preface, that his attention has been particularly called to the subject of the manufacture of sugar, by the circumstance of his having obtained the grant of a patent for an invention, which he does not doubt will be eminently useful to the sugar planter, in the successful and economical manufacture of his produce; and further, that in attempting to supply the deficiency, which he has detected as arising from the want of any publication in our own language of adequate authority on the general nature of the subject, he has not relied alone on his own experience, but has availed himself of every source of knowledge to which he could obtain access.

In the first chapter, Mr. Porter endeavours to trace the origin of the sugar cane, and gives a brief sketch of its gradual progress throughout the world, to the time of its produce being considered almost a necessary of life in every civilized land. He then gives a description of the plant in its botanical character, as well as of its peculiar properties, and the manner of its secreting its juice; and proceeds to point out the influence of soil and climate in the cultivation, and the vegetable economy of the plant.

In the sixth chapter, in speaking of the expressed juice, he remarks—

The proportion and quality of the different juices vary, more or less, in the cane liquor, depending, not only on the kind of cane and the season, but also on numerous other local circumstances. The water which the liquor contains must be considered under two different relations; the one holding the mucus and mucilage in a saturated solution: this is called the water of solution, and, combined with these matters, takes the name of sirop; the second is the superabundant water, and is generally from sixty to eighty-five per cent. in quantity, over and above the water of solution.

In order to exhibit the relative proportions of water and sirop, we give the following table, taken from Dr. Dutrone's work; an authority which we have uniformly found so accurate, that we do not hesitate to take this table as a guide. It is constructed from experiments made with solutions of very pure sugar, taken at all degrees of the saccharometer. By means of the saccharometer and this table, the proportion of sugar contained in the expressed juice may be immediately ascertained, and the quantity of water which must be evaporated, to bring it to the point of saturation, can be accurately determined. It will also enable us to judge, by approximation, of the proportion of water and soluble matter contained in juices of middling and bad qualities.

Table of the quantity of Sugar contained in one hundred pounds of expressed cane juice or sirop of good quality; and also of the quantity of water that must be evaporated, to reduce the same to the state of saturated sirop, taken at each degree of the saccharometer.

Scale of Baume's Degrees.	Weight of Sugar in each 100 lbs. juice or sirop.			Weight of Water in each 100 lbs. juice or sirop, beyond the water of solution.			Specific gravities of solutions at each Degree.			
	lbs.	oz.	dr.	lbs.	oz.	dr.	Deg.	Sp. gr.	Deg.	Sp. gr.
1	1	13	6	97	..	15	1	1006	35	1312
2	3	10	12	94	1	14	2	1013	36	1324
3	5	8	3	91	2	13	3	1020	37	1336
4	7	5	10	88	3	12	4	1028	38	1349
5	9	3	..	85	4	10	5	1035	39	1361
6	11	..	7	82	5	11	6	1042	40	1374
7	12	13	14	79	6	9	7	1050	41	1386
8	14	11	4	76	7	8	8	1058	42	1400
9	16	8	11	73	8	7	9	1065	43	1413
10	18	6	1	70	9	6	10	1073	44	1427
11	20	3	8	67	10	5	11	1181	45	1441
12	22	..	15	64	11	4	12	1090	46	1456
13	23	14	5	61	12	3	13	1100	47	1470
14	25	11	12	58	13	3	14	1106	48	1485
15	27	9	2	55	14	1	15	1114	49	1500
16	29	6	9	52	15	1	16	1125	50	1515
17	31	4	..	50	..	..	17	1132	55	1618
18	33	1	6	47	..	15	18	1140		
19	34	14	13	44	1	14	19	1148		
20	36	12	3	41	2	13	20	1157		
21	38	9	10	38	3	12	21	1167		
22	40	7	1	35	4	11	22	1176		
23	42	4	7	32	5	10	23	1186		
24	44	1	14	29	6	9	24	1195		
25	45	15	4	26	7	8	25	1205		
26	47	12	11	23	8	7	26	1215		
27	49	10	1	20	9	6	27	1225		
28	51	7	8	17	10	5	28	1235		
29	53	4	15	14	11	4	29	1246		
30	55	2	5	11	12	3	30	1256		
31	56	15	12	8	13	2	31	1267		
32	58	13	3	5	14	1	32	1278		
33	60	10	9	2	15	..	33	1289		
34	62	8	..				34	1301		

A saturated solution of very pure sugar contains five parts of sugar and three parts of water. This is indicated by 34° of Baume's saccharometer, at the temperature of 82° Fah.

The variation in the proportion of superabundant water is sometimes so considerable, that Dutrone found in the same plantation, at three months' interval, cane-juice, differing from 5° to 14° of the saccharometer. The first contained, according to the table, 9 lbs. 3 oz.; the second 25 lbs. 11 oz. of sugar in 100 lbs. of juice.

Cazaud found that in January, four hundred gallons of juice commonly yielded forty-eight gallons of sugar and molasses, one with the other; in February, from fifty-six to sixty-four; in March, from

sixty-four to seventy-two; and in April, sometimes eighty. He affirms, that the dryness of the season, and not the age of the canes, is the cause of this increase of produce: he considers the greatest relative maturity of the canes to be, when the juice is four parts water and one part sugar and molasses. Edwards considers the average proportion to be eight parts water and two sugar and molasses, the latter equally divided.

The juice of canes, just arrived at their full growth, is in the sweet mucous state; this, when clarified and concentrated, assumes a very deep brown colour, and becomes sirop of very thick consistency; if the heat applied be greater than 221° Fah. it will be decomposed; if the juice be expressed from the cane while maturing, the mucous juice is then in the saccharine state, and when clarified and concentrated, produces sirop of a very deep colour and thick consistence; it can scarcely support 225° Fah. without decomposition, while the mucous juice, in the state of essential salt, remains undecomposed at the heat of 260°, and pure sugar will bear exposure to 300°, and even higher, without injury.

It can now be easily perceived, how greatly the presence of sweet and saccharine juices is injurious to the manufacture of sugar, when, as is now always the case, degrees of heat are used sufficiently high to decompose them. The mucilage is more or less abundant according to the nature of the cane and the situation in which it grows; it is the colouring matter of the juice, which varies from lemon colour to a deep brown, according as the heat and alkalis, in separating this matter from the feculencies, increases the proportion of mucilage which is held in solution by the fluids. We have already said that alkalis, combining with the mucilage, give intensity to its colour in proportion to their causticity, and the smell peculiar to the cane is lost in that of leys.

Mineral and acetic acids revive the yellow colour of the juice, and change it to amber, more or less dark, according to their strength. The vegetable acids, such as cream of tartar, citric acid, &c. &c. weaken and partially destroy its colour; oxalic acid destroys it entirely, when the base of this juice, deprived of the colouring principle which held it in solution, shows it under a solid form, white and insoluble in all menstrua. It can readily be conceived that the mucilage, having for its base a substance which is only held in solution by a colouring principle, will injure the crystallization of the sugar in proportion to the quantity of that mucilage which is contained in the expressed juice; whence it may be concluded, that alkalis are injurious in proportion to their activity in separating the mucilage from the feculent parts, and that, in the necessity of employing them to clarify the expressed juice, we should carefully seek for every means of judiciously conducting the operation. This delicate and important office is, however, generally performed in the most slovenly and careless manner.

We next have a description of the general method of manufacturing the juice into sugar, as practised in our colonies, and also of the distillation of rum from the molasses and other matters usually sub-

jected to this process. From the next chapter, which describes at considerable length the French method of manufacturing sugar, as practised by Dutrone, we propose making some extracts.

In speaking of Dutrone he says—After having examined with the greatest care, and in every possible point of view, the means generally in use in his time; after having minutely and profoundly studied the nature of the cane, and acquired the most intimate knowledge of its juice, he discovered and adopted what he considered the most advantageous method for the manufacture of this juice. Many methods seem to have passed in review before him, and many appear to have been rejected before he ultimately fixed his choice. In this selection he was guided, by experience, to the adoption of plans in agreement with the soundest principles of chemistry, and appeals to the result as confirming the propriety of his choice.

In the description about to be given, every operation will be shown perfectly distinct; it will be seen, that each follows the other without confusion, or intermixture; that every step of this method, and the order of its progress, is simple, easy to be understood, and certain in its execution. It will readily be acknowledged, that this progress can be applied to all circumstances under which the juice may be found; that it does not always require the presence of the superintendent; that it may be confided to persons comparatively ignorant, without their being able to derange it, and that all the faults, which are the inevitable effect of negligence, can be repaired with smaller loss than has usually arisen from similar causes.

Dutrone was convinced of the absolute impossibility of entirely removing, by the scummer, the impurities belonging to the juice, and the extraneous earthy matters, which are always in a greater or less proportion found in it; he therefore saw that it was absolutely indispensable to filter, and to leave the cane liquor to deposit before concentrating. For this purpose he adapted two reservoirs, to communicate with the concentrating vessels, which fulfilled this end admirably well, and produced the greatest advantages.

In order that every operation which the manufacture of the juice requires, and the order which it ought to keep, may be easily seen and followed, we will explain the arrangement of the interior of a sugar-house, which Dutrone conceives best qualified for the proper application of this method. All the operations required can be accomplished, either by the assistance of one furnace or two separate ones. In the greatest number of plantations one furnace is preferable, because, while it equally well accomplishes the proposed end, it effects economy of fuel and labour. In very large plantations, where the most powerful means are required, two furnaces should be erected, but it will make no difference in the arrangement of the sugar-house. The vessels used for boiling, are called, collectively, the laboratory, which generally consists of three or four boilers placed in a line. Whatever may be the disposition of the laboratory, the order of the work is the same. The laboratory should be placed in the sugar-house, in such a manner that its two sides and the end, formed by the concentrating pan, should be isolated through

the whole extent, in order that the attendance on them may be easy, and that the negroes may be able to execute, with the greatest economy of time and of means, every thing proper to be done for the greatest perfection of the work. The laboratory, in the interior of a sugar-house, has four copper vessels, the capacity of each ought to be from 300 to 600 gallons.* The first, which receives the expressed juice, is called the first clarifier; the next, the second clarifier, the third, the evaporator, the fourth, the concentrator. These vessels are placed very near to each other, and have only an edge of two or three inches thickness between them. The masonry in which they are set forms the sides of the laboratory, the least thickness of which, at the upper part, is about fifteen or eighteen inches. The surface of this masonry is inclined seven or eight inches from the outer edge to the lip of the boilers; there are between each of these, basins let into the masonry, where the scum which is taken off is put, and this is carried back, by channels, to the first clarifier: between this vessel and the wall is a basin, which receives the first feculencies, whence they flow, through a pipe, to a vessel placed underneath to receive them. These basins and channels are made of lead, soldered to a setting of copper, which covers the surface of the masonry of the laboratory; this setting is soldered to the circumference of the boilers, which are also soldered to each other; in this state the laboratory offers the best adaptation to the desired end.

It should be remarked, that in the centre of the basins, which are between the evaporator and the concentrator, there is an opening to a canal, which descends in the thickness of the masonry, and which is then continued horizontally to the bottom of a copper vessel, placed at the foot of the reservoirs for filtration and subsidence. On the surface of the laboratory, on each side of the concentrator, there are canals which proceed from the reservoirs through the brick work, and open near the brim of the boiler. A cooler, placed at the end of the concentrator, forms also part of the laboratory. Two reservoirs, placed at a little distance from the laboratory, serve for filtration and subsidence. The filters ought to be large enough to contain all the expressed juice (diminished to the state of sirop, indicating twenty-four or twenty-six degrees of the saccharometer,) which the mill can furnish in twenty-four hours; they ought to be made of masonry, lined with lead, and entirely covered with several sieves, the bottoms of which may be made with osier hurdles. There are fixed on these bottoms, for the purpose of filtration, first a woollen, then a linen cloth, and lastly a reticulation of brass wire. Two leaden canals form a communication between the reservoirs and the labo-

* Their dimensions are—

	Depth.	Diameter. *Top.*	Diameter. *Bottom.*
a - -	27 inches.	88 inches.	64 inches.
b - -	28 "	88 "	64 "
c - -	29 "	80 "	62 "
d - -	30 "	78 "	60 "

Their bottoms are slightly convex.

ratory, the one conveys the evaporated sirop to the vessel placed at the foot of each reservoir, from whence it is poured upon the filters; the other, the opening of which, at the bottom of the reservoir, is shut by a valve, carries back the sirop, filtered and subsided, to the concentrator. The bottom of the reservoir for subsidence, ought to be raised half an inch above the level of the opening of the canal, near the brim of the concentrator. The sugar-house ought to have two laboratories, and each laboratory ought to communicate with the reservoirs.* The reservoirs for the expressed juice are common, or proper, to each laboratory; they are placed outside the sugar-house, as much for cleanliness as for preserving the juice cool; they ought to be covered by a well inclosed shed, or vaulted over. These reservoirs, lined with lead, should each be large enough to contain three hundred and seventy-five gallons, at the least; they ought to be always filled to a fixed and determinate height, equal to one charge,† in order that not only an exact account may be kept of the quantity of expressed juice which comes to the sugar-house, but also of the quantity of lime that should be employed to separate the feculencies from the juice. As it is highly proper to know the degree of richness of the juice to be manufactured, there should be a saccharometer to ascertain it from time to time.

[TO BE CONTINUED.]

The Results of Machinery, namely, Cheap Production and Increased Employment Exhibited; being an Address to the Working Men of the United Kingdom. Forming No. 1 *of the Working Man's Companion.*

THIS is a work just published by the Society for the Diffusion of Useful Knowledge. We can imagine nothing more suitable to the general mass of readers, and are quite sure that nothing could have been better timed. It is the very thing that was wanted to dispel that great popular delusion which has made the events of the year 1830 an absolute disgrace to us as a civilized and manufacturing people. It is the strong right arm of reason put forth in aid of the comparatively weak arm of the law. In manner and matter it is alike admirable; the style simple and familiar—the reasoning clear—the illustrations copious and well chosen—and the treatment of the subject altogether so satisfactory, that not a shadow of doubt can rest on any willing mind of the soundness of the general conclusion which it is the great purpose of the book to enforce; namely, that to oppose machinery, is to oppose the very best friend the poor, as well as rich, ever had.

* It is always better to have two fire places, though only one should be used at a time, lest any accident should happen to the one in use. This precaution is more necessary, since, as the canes cannot be kept without fermenting, all those which were cut would be lost.

† The charge must be a determinate quantity, which ought never to vary when once fixed.

The writer enters on his subject in a manner singularly well calculated to arrest the attention of those classes to whom it is more particularly addressed.

"In the year 1827, a Committee of the House of Commons was appointed to examine into the subject of emigration--that is, to see whether it was desirable and practicable to remove distressed labourers from the United Kingdom to distant places, where their labour might be employed profitably to themselves and others. The first person examined before that committee was Joseph Foster, a working weaver of Glasgow. He told the committee, that he and many others, who had formed themselves into a society, were in great distress; that numbers of them worked at the hand-loom from eighteen to nineteen hours a-day, and that their earnings at the utmost did not amount to more than seven shillings a week, and that sometimes they were as low as four shillings. That twenty years before that time they could readily earn a pound a-week by the same industry; and that as power-loom weaving had increased, the distress of the hand weavers also had increased in the same proportion. A power-loom is one worked by machinery, and not by the hand of man, as most of our readers, perhaps, know. The committee then put to Joseph Foster the following questions, and received the following answers:—

"Q. 'Are the committee to understand that you attribute the insufficiency of your remuneration for your labour to the introduction of machinery?'

"A. 'Yes.'

"Q. 'Do you consider, therefore, that the introduction of machinery is objectionable?'

"A. 'We do not. The weavers in general, of Glasgow and its vicinity, do not consider that machinery can or ought to be stopped, or put down. They know perfectly well that machinery must go on, that it will go on, and that it is impossible to stop it. They are aware that every implement of agriculture or manufacture is a portion of machinery, and, indeed, every thing that goes beyond the teeth and nails, (if I may use the expression,) is a machine. I am authorized, by the majority of our society, to say, that I speak their minds, as well as my own, in stating this.'

"If all, or if a large majority of the working men of our country had come to the same sound opinions as Joseph Foster, we should not take the trouble, because it would be needless, now to address them. But when we hear on all sides that misguided men are violating the laws by which the rights of all are protected; that they are wickedly and ignorantly destroying the property of the farmer and the manufacturer, in the belief that machinery *can* be stopped or put down; that they do *not* know, as the poor weavers of Glasgow *did* know, that machinery must go on, will go on, and that it is impossible to stop it; we think it our duty, having the means of appealing to their reason and to their regard for their own interests, to endeavour to bring their minds to the same conclusions as those of the respectable weaver, whose words we have repeated. He felt that, although he was in his own person a sufferer from the improvement

of machinery, it was utterly out of his power, because it was contrary to his reason, and to the reason of all thinking people, whether working men or not, to resist the progress of that improvement. There are many working men who entertain the same sound opinions, which they have come to, probably, by an accurate and dispassionate observation of the facts which are within their own view. To such men we hope to offer many new facts to strengthen their opinions; and we rely greatly upon their influence to point out their errors either to those who are violating the laws, or to those who think the violators of the laws have justice on their side. For the benefit of you all, the informed as well as the uninformed, we address you as men capable of reasoning. We give you a great body of facts to reason upon. We offer nothing to your passions or your prejudices. We shall attempt to make you feel, by bringing before you the same sort of facts by which that sensible man, Joseph Foster, convinced his own mind, that although your individual labour may be partially displaced, or unsettled, for a time, by the use of a cheaper and a better power, which power is machinery, you are great gainers by the general use of that power. We shall strive to show you, that through this power you possess, however poor you may be, many of the comforts which make the difference between man in a civilized and man in a savage state; and further, that, in consequence of machinery having rendered productions of all sorts cheaper, and therefore caused them to be more universally purchased, it has really increased the demand for that manual labour, which it appears to some of you, reasoning only from a few instances, it has a tendency to diminish. If we make out these propositions, we think you will agree with Joseph Foster, that the introduction of machinery is not objectionable."

But, first of all, what is this *machinery* against which such an outcry is raised? There are persons who affect to make a distinction between tools and machines; but the writer shows, with great force and clearness, that the principle of both is precisely the same.

"A tool of the simplest construction is a machine; a machine of the most curious construction is only a complicated tool. There are many cases in the arts, and there may be cases in agriculture, in which the human arm and hand, with or without a tool, may do work that no machine can so well perform. There are processes in polishing, and there is a process in copper-plate printing, in which no substance has been found to stand in the place of the human hand. And if, therefore, the man with a spade alone, does a certain agricultural work more completely than a man guiding a plough, and a team of horses dragging it, (which we do not affirm or deny,) the only reason for this is, that the man with the spade is a better machine than the man with the plough and the horses. The most stupid man that ever existed is, beyond all comparison, a machine more cunningly made by the hands of his Creator, more perfect in all his several parts, and with all his parts more exquisitely adapted to the regulated movement of the whole body, less liable to accidents, and less injured by wear and tear, than the most beautiful machine that

ever was, or ever will be, invented. There is no possibility of supplying, in many cases, a substitute for the simplest movements of man's body, by the most complicated movements of the most ingenious machinery. And why so? Because the natural machinery by which a man even lifts his hand to his head is at once so complex and so simple, so apparently easy, and yet so entirely dependant upon the right adjustment of a great many contrary forces, that no automaton, or machine imitating the actions of man, could ever be made to effect this seemingly simple motion, without showing that the contrivance was imperfect—that it was a mere imitation, and a very clumsy one. What an easy thing it appears to be for a farming man to thrash his corn with a flail; and yet what an expensive arrangement of wheels is necessary to produce the same effects with a thrashing machine. The truth is, that the man's arm and the flail form a much more curious machine than the other machine of wheels, which does the same work; and the real question, as regards the value of the two machines, is, which machine in the greater degree lessens the cost of production?

"We state this principle broadly, in our examination into the value of machinery in diminishing the cost of producing human food. A machine is not perfect because it is made of wheels or cylinders, employs the power of the screw or the lever, is driven by wind, or water, or steam, but because it best assists the labour of man, by calling into action some power which he does not possess in himself. If we could imagine a man entirely dispossessed of this power, we should see the feeblest of animal beings. He has no tools which are a part of himself, to build houses like the beaver, or cells like the bee. He has not even learnt from nature to build, instinctively, by certain and unchangeable rules. His power is in his mind; and that mind teaches him to subject all the physical world to his dominion, by availing himself of the forces which nature has spread around him. To act upon material objects, he arms his weakness with tools and with machines. As we have before said, tools and machines are, in principle, the same. When we strike a nail upon the head with a hammer, we avail ourselves of a power which we find in nature—the effect produced by the concussion of two bodies; when we employ a water wheel to beat out a lump of iron with a much larger hammer, we still avail ourselves of the same power. There is no difference in the nature of the instruments, although we call the one a tool, and the other a machine. Neither the tool nor the machine have any force of themselves. In one case the force is in the arm, in the other in the weight of water which turns the wheel."

It is next shown that even tools of the very simplest description are not to be obtained without the aid of machinery.

"All labourers in agriculture know, full well, the value of a tool; but some hate machinery. This is inconsistent. Unless the labourer made a plough, (if he will consent even to a plough,) out of two pieces of stick, and carried it upon his shoulder to the field, as the toil-worn and poor people of India do, he must have some *iron* about

it. He cannot get iron *without machinery*. But he hates machinery, and therefore he will have nothing to do with a plough! Will he have his hoe, then? He is not quite sure. Will he give up his knife? No; he must keep his knife. He has got every thing to do for himself, and his knife is his tool of all-work.

"Well, how does he get this same knife? People that have no machinery sharpen a stone, or bit of shell, or bone, and cut or saw with it in the best way they can; and after they have become very clever, they fasten it to a wooden handle with a cord of bark. An Englishman examines two or three dozens of knives, selects which he thinks the best, and pays a shilling for it, the seller thanking him for his custom. The man who has nothing but the bone or the shell would gladly toil a month for that which does not cost an English labourer half a day's wages.

"And how does the Englishman obtain his knife upon such easy terms? From the very same cause that he obtains all his other accommodations cheaper, in comparison with the ordinary wages of labour, than the inhabitant of any other country—that is, from the use of machinery, either in the making of the thing itself, or in procuring that without which it could not be made.

* * * * * *

"Ready made, without the labour of some other man, a knife does not exist; but the iron of which the knife is made, is to be had. Very little iron has ever been found in a native state, or fit for the blacksmith. The little that has been found in that state has been found only very lately; and if human art had not been able to procure any in addition to that, gold would have been cheap as compared with iron.

"Iron is, no doubt, very abundant in nature; but it is always mixed with some other substance that not only renders it unfit for use, but hides its qualities. It is found in the state of what is called iron ore, a stone or earth of some kind or other. Sometimes it is mixed with clay, at other times with lime or flint; and there are cases in which it is so much mixed with sulphur, that it burns like a piece of coal if put in the fire. In short, in the state in which iron is met with, it is a much more likely substance for paving a road, or building a wall, or making mortar, than for making a knife.

"But suppose that the man knows the particular ore or stone that contains the iron, how is he to get it out? Mere force will not do; for the iron and the clay, or other substance, are so nicely mixed, that though the ore were ground to the finest powder, the grinder is no nearer the iron than when he had a lump of a ton weight.

"A man who has a block of wood has a wooden bowl in the heart of it; and he can get it out too by labour. The knife will do it for him in time; and if he take it to the turner, the turner with his machinery, his lathe, and his gouge, will work it out for him in half an hour. The man who has a lump of iron ore has just as certainly a knife in the heart of it; but no mere labour can work it out. Shape it as you may, it is not a knife, or steel, or even iron—it is iron ore;

and dress it as you will, it would not cut better than a brick-bat—certainly not so well as the shell or bone of the savage.

"There must be knowledge before any thing can be done in this case. We must know what is mixed with the iron, and how to separate it. We cannot do it by mere labour, as we can chip away the wood and get out the bowl; and therefore we have recourse to fire."

After describing in an equally popular and instructive style the processes of making cast-iron, bar, or malleable iron, and steel, the author thus sums up the general result.

"Bringing it, (the ore,) into this state, requires great force; and the unaided strength of all the men in Britain could not make all the iron which is at present made, though they did nothing else. Machinery is therefore resorted to; and water-wheels, steam engines, and all sorts of powers are set to work in moving hammers, turning rollers, and drawing rods and wires through holes, till every workman can have the particular form which he wants. If it were not for the machinery that is employed in the manufacture, no man could obtain a spade for less than a year's labour; the yokes of a horse would cost more than the horse himself; and the farmer would have to return to wooden ploughshares, and hoes made of sticks with wooden ends."

* * * * * *

"As iron is with us almost as plentiful as stone, we do not think much about it. But there is a great deal to be done, much thinking and inventing, before so simple a thing as a sixpenny knife could be procured: and without the thinking and the inventing all the strength of all the men that ever lived never could procure it; and without the machinery to lighten the labour, no ingenuity could furnish it at a thousand times the expense."

Another very striking illustration of the influence of machinery in diminishing the cost of production and improving the general condition of men, is drawn from the history of the processes for grinding corn. After mentioning an instance of a New Zealander, who, on returning from a visit to England, carried home with him "a small hand-mill for grinding corn, which he prized as the greatest of all earthly possessions," the writer proceeds:—

"And well might he prize it! He had no machine for converting corn into meal but two stones, such as were used in the remote parts of the Highlands of Scotland some years ago. And to beat the grain into meal by these two stones, (a machine, remember, however imperfect,) would occupy the labour of one-fourth of his family, to procure subsistence for the other three-fourths. The ancient Greeks, three thousand years ago, had improved upon the machinery of the hand-stones, for they had hand-mills. But Homer, the old Greek poet, describes the unhappy condition of the slave who was always employed in using this mill. The groans of the slave were unheeded by those who consumed the produce of his labour; and such was the necessity for meal, that the women were compelled to turn these mills when there were not slaves enough taken in war to perform

this irksome office. There was plenty of labour then to be performed, even with the machinery of the hand-mill; but the slaves and the women did not consider that labour was a good in itself, and therefore they bitterly groaned under it. By and bye, the understanding of men found out that water and wind would do the same work that the slaves and the women had done; and that a large quantity of labour was at liberty to be employed for other purposes. You perhaps think that society was in a worse state in consequence. We will tell you exactly in what respects society gains, and what you gain as part of society, by the abolition of hand mills, and the use of wind-mills and water-mills for grinding corn.

"Labour is worth nothing without results. Its value is only to be measured by what it produces. If in a country where hand-mills could be had, the people were to go on beating grain between two stones, you would pronounce them fools, because they could obtain an equal quantity of meal with a much less expenditure of labour. You have perhaps a general prejudice against that sort of machinery which does its work with very little human assistance; it is not quite so certain, therefore, that you would agree that a people would be equal fools to use the hand-mill when they could employ the wind-mill or the water-mill. But we believe you would think, that if flour could drop from heaven, or be had like water by whoever chose to seek it, it would be the height of folly to have stones, or hand-mills, or water-mills, or wind-mills, or any machine whatever for manufacturing flour. Do you ever think of *manufacturing* water? The cost of water is only the cost of the labour which brings it to the place in which it is consumed. Yet this admission overturns all your objections against machinery. *You admit that it is desirable to obtain a thing with no labour at all; can you therefore doubt that it is desirable to obtain it with the least possible labour?* The only difference between no labour and a little labour, is the difference of the cost of production. And the only difference between little labour and much labour is precisely the same. In procuring any thing that administers to his necessities, man makes an exchange of his labour for the thing produced, and the less he gives of his labour, the better of course is his bargain.

"To return to the hand-mill and the water-mill. An ordinary water-mill for grinding corn will grind about thirty-six sacks a-day. To do the same work with a hand-mill would require 150 men. At 2*s.* a-day, the wages of these men would amount to 15*l.* which, reckoning 6 working days, is 90*l.* a week, or 4680*l.* a year. The rent and taxes of a mill would be 150*l.* a year, or ten shillings a working day. The cost of machinery would be certainly more for the hand-mills than the water-mill, therefore we will not take the cost of machinery into the calculation. To produce, therefore, thirty-six sacks of flour by hand, we should pay 15*l*; by the water-mill we should pay ten shillings; that is, we should pay thirty times as much by the one process as by the other, The actual saving is something about one-half of the price of the flour in the market; that is, the consumer, if the corn were ground by hand, would pay double what he pays now

that it is ground at a mill. He pays 10*d.* for his quartern loaf now; he would pay 20*d.* then.

"But if the system of grinding corn by hand were a very recent system of society, and the introduction of so great a benefit as the water-mill had all at once displaced the hand-grinders, as the spinning machinery displaced the spinning-wheel, what must become, you say, of the one hundred and fifty men who earned the 15*l.* a-day, of which sum, the consumer has now got 14*l.* 10*s.* in his pocket? They must go to other work. And what is to set them to that work? The same 14*l.* 10*s.* which, being saved in the price of flour, gives the poor man, as well as the rich man, more animal food and fuel; a greater quantity of clothes, and of a better quality; better furniture, and more of it; and, above all, more books. To produce these things there must be more labourers employed than before. The quantity of labour is, therefore, not diminished, while its productiveness is much increased. It is as if every man among us had become suddenly much stronger and more industrious. The machines labour for us, and are yet satisfied without either food or clothing. They increase all our comforts, and they consume none themselves. The hand-mills are not grinding, it is true; but the ships are sailing that bring us foreign produce; the looms are moving that give us more clothes; the potter, and glass-maker, and joiner, are each employed to add to our household goods; we are each of us elevated in the scale of society; and all these things happen because machinery has diminished the cost of production."

(TO BE CONTINUED.)

Preliminary Discourse on the Study of Natural Philosophy. By JOHN FREDERICK WILLIAM HERSCHEL, *Esq. A. M. late Fellow of St. John's College, Cambridge, &c.*

THIS work is calculated to be of great and extensive utility. In an age like the present, in which the means of acquiring knowledge are no longer out of the reach even of the humblest classes of society, it becomes of the utmost importance that the numberless inquiries after the truths of nature should be directed in the right path to the acquisition of the knowledge they desire; and that those who have hitherto neglected the study, from a notion of its dryness or unprofitableness, should be aroused to it by proofs of its amusing and highly useful character. To effect these too objects seems to us to be the principal aim of the author.

The discourse commences most judiciously. General readers are apt to be deterred from the perusal of a book of this nature, from an idea that the subject is necessarily a dull, and, to the uninitiated, an uninteresting one. Aware of this, Mr. Herschel strives, and strives effectually, to invest the introductory portion of his work with as much of popular interest as possible; and, by means of the introduction of numerous apposite illustrations, and of anecdotes, to render it as amusing as any tale, while the reader is unconsciously

led on to the portals of scientific inquiry. In this part, too, he takes occasion to refute the common-place objection, that science is of no practical utility. Mr. Herschel exposes its fallacy in the most simple and convincing way, by producing unanswerable instances of the wonderful effects which have been, and are daily, produced by a proper application of the laws of nature, and by showing, that without the knowledge of those laws, man is deprived of the most effectual means of raising himself above the level of the rest of the animal creation. The following extract will show how triumphantly he proves the importance of this knowledge, and, at the same time, will exemplify the remarks we have made above as to the entertaining style of this part of the work; the paragraphs, it will be noticed, are numbered—a very great help to facility of reference.

"35. But if the laws of nature, on the one hand, are invincible opponents, on the other they are irresistible auxiliaries, and it will not be amiss if we regard them in each of these characters, and consider the great importance of a knowledge of them to mankind.

"I. In showing us how to avoid attempting impossibilities.

"II. In securing us from important mistakes in attempting what is in itself possible, by means either inadequate or actually opposed to the end in view.

"III. In enabling us to accomplish our ends in the easiest, shortest, most economical, and most effectual manner.

"IV. In inducing us to attempt, and enabling us to accomplish, objects which but for such knowledge we should never have thought of undertaking.

"We shall, therefore, proceed to illustrate by examples the effect of physical knowledge under each of these heads.

"36. Ex. 1. (35.) I. It is not many years since an attempt was made to establish a colliery at Bexhill, in Sussex. The appearance of thin seams and sheets of fossil-wood and wood-coal, with some other indications similar to what occur in the neighbourhood of the great coal beds in the north of England, having led to the sinking of a shaft and the erection of machinery, on a scale of vast expense, not less that £80,000 are said to have been laid out on this project, which, it is almost needless to add, proved completely abortive, as every geologist would have at once declared it must, the whole assemblage of geological facts being adverse to the existence of a regular coal-bed *in* the Hastings *sand;* while this, on which Bexhill is situated, is separated from the *coal strata* by a series of interposed beds of such enormous thickness as to render all idea of penetrating *through* them absurd. The history of mining operations is full of similar cases, where a very moderate acquaintance with the usual *order of nature*, to say nothing of theoretical views, would have saved many a sanguine adventurer from utter ruin.

"37. Ex. 2. (35.) II. The smelting of iron requires the application of the most violent heat that can be raised, and is commonly performed in tall furnaces, urged by great iron bellows driven by steam engines. Instead of employing this power to force *air* into the furnace, through the intervention of bellows, it was on one occa-

sion attempted to employ the steam itself in apparently a much less circuitous manner, viz. by directing the current of steam in a violent blast from the boiler at once into the fire. From one of the known ingredients of steam being a highly inflammable body, and the other that essential part of the air which supports combustion, it was imagined that this would have the effect of increasing the fire to tenfold fury, whereas it simply *blew it out:* a result which a slight consideration of the laws of chemical combination, and the state in which the ingredient elements exist in steam, would have enabled any one to predict without a trial."—p. 44.

Well would it have been for many an ingenious projector if he had paused in the prosecution of a favourite scheme, until he had inquired whether its success might not be incompatible with the unalterable laws which regulate the economy of the universe. Many unfortunate instances have not been wanting in which suicide has been the termination of a career of attempted discovery, a result which might have been avoided, in most cases, by merely a slight devotion to the study of natural philosophy. The melancholy end of a schemer of this description, who perished, (unintentionally,) by his own act, and in the very moment of anticipated triumph, is thus related in the volume before us:—

"38. Ex. 3. (35.) II. After the invention of the diving-bell, and its success in subaqueous processes, it was considered highly desirable to devise some means of remaining for any length of time under water, and rising at pleasure without assistance, so as either to examine at leisure the bottom, or perform at ease any work that might be required. Some years ago an ingenious individual proposed a project by which this end was to be accomplished. It consisted in sinking the hull of a ship made quite water-tight, with the decks and sides strongly supported by shores, and the only entry secured by a stout trap-door in such a manner that by disengaging from within the weights required to support it, it might rise of itself to the surface. To render the trial more satisfactory, and the result more striking, the projector himself made the first essay. It was agreed that he should sink in twenty fathoms water, and rise again without assistance at the expiration of 24 hours. Accordingly, making all secure, fastening down his trap-door, and provided with all necessaries as well as with the means of making signals to indicate his situation, this unhappy victim of his own ingenuity entered and was sunk. No signal was made, and the time appointed elapsed. An immense concourse of people had assembled to witness his rising, but in vain, for the vessel was never seen more. The pressure of water at so great a depth had, no doubt, been completely under estimated, and the sides of the vessel being at once crushed in, the unfortunate projector perished before he could even make the signal concerted to indicate his distress."

These examples might be enough to prove his proposition, but our author with a lavish hand, makes his position doubly strong by a few more modern instances. We have already quoted rather largely

from them, but we cannot resist the temptation of giving the following, it is so completely and directly to the point:—

"39. Ex. 4. (35.) III. In the granite quarries near Seringapatam the most enormous blocks are separated from the solid rock by the following neat and simple process:—The workman having found a portion of the rock sufficiently extensive and situated near the edge of the part already quarried, lays bare the upper surface and marks on it a line in the direction of the intended separation, along which a groove is cut with a chisel about a couple of inches in depth. Above this groove a narrow line of fire is then kindled, and maintained till the rock below is thoroughly heated, immediately on which a line of men and women, each provided with a pot full of cold water, suddenly sweep off the ashes, and pour the water into the heated groove, when the rock at once splits with a clean fracture. Square blocks of 6 feet in the side and upwards of 80 feet in length,* are sometimes detached by this method, or by another equally simple and efficacious, but not easily explained without entering into particulars of mineralogical detail."

Mr. Herschel winds up this branch of the subject with the following just observation:—

"41. Ex. 6. (35.) III. To accomplish our ends quickly is often of at least as much importance as to accomplish them with little labour and expense. There are innumerable processes which, if left to themselves, *i. e.* to the ordinary operation of natural causes, are done, and well done, but with extreme slowness; and in such cases it is often of the highest practical importance to accelerate them. The bleaching of linen, for instance, performed in the natural way by exposure to the sun, rain, and wind, requires many weeks or even months for its completion; whereas by the simple immersion of the cloth in a liquid, chemically prepared, the same effect is produced in a few hours. The whole circle of the arts, indeed, is nothing but one continued comment upon this head of our subject. The instances above given are selected, not on account of their superior importance, but for the simplicity and *directness* of application of the principles on which they depend, to the objects intended to be attained."—p. 49.

One class of objectors thus satisfactorily disposed of, Mr. Herschel shortly after takes occasion, incidentally, to combat the opinions of another—those who admit the benefit of scientific knowledge, but, at the same time, contend that it should not be extended to the many. Mr. Herschel is, as we have observed, one of the most brilliant living luminaries of the world of science—he has been acknowledged worthy of becoming the head of one of our most learned, and perhaps, at the same time, one of our most aristocratic societies. His opinion, therefore, on the subject of the expediency of preserving a monopoly of knowledge, cannot be uninteresting:—

"63. Knowledge can neither be adequately cultivated nor adequately enjoyed by a few; and, although the conditions of our exist-

* Such a block would weigh between 4 and 500,000 lbs.

ence on earth may be such as to preclude an abundant supply of the physical necessities of all who may be born, there is no such law of nature in force against that of our moral and intellectual wants. Knowledge is not, like food, destroyed by use, but rather augmented and perfected. * * * * Those who admire knowledge for its own sake, ought to wish to see its elements made accessible to all, were it only that they may be the more thoroughly examined into, and more effectually developed in their consequences, and receive that ductility and plastic quality which the pressure of minds of all descriptions, constantly moulding them to their purposes, can alone bestow.—"p. 69.

What can be more conclusive than this? What greater triumph for the advocates of the diffusion of scientific knowledge among the humbler classes of the people, for the promoters of those institutions whose establishment may not unlikely create a new era in the history of arts and sciences? The question of their utility, (if question it ever was,) is now settled—for Mr. Herschel's arguments cannot be easily invalidated.

Perhaps we have lingered too long on the first division of this Preliminary Discourse—if so, the fascinating nature of its contents must plead our excuse. To be more methodical, our author divides his subject into three parts.

"Part I.—Of the general nature and advantages of the study of the physical sciences."

"Part II.—Of the principles on which physical science relies for its successful prosecution, and the rules by which a systematic examination of nature should be conducted."

"Part III. Of the subdivision of physics into distinct branches and their mutual relations."

"Of the first division we have already given some account; besides, however, developing the importance of physical science, combatting the objections of the opponents to its diffusion, and inciting the undetermined or the indifferent to its study, it contains a masterly sketch of the various motive-forces in nature, at the conclusion of which the enlightened author pays the following gratifying tribute to the importance of practical mechanics.

"58. Such are the forces which nature lends us for the accomplishment of our purposes, and which it is the province of practical mechanics to teach us to combine and apply in the most advantageous manner; without which the mere command of power would amount to nothing. Practical mechanics is, in the most pre-eminent sense, a *scientific art;* and it may be truly asserted, that almost all the great combinations of modern mechanism, and many of its refinements and nicer improvements, are creations of pure intellect, grounding its exertions upon a moderate number of very elementary propositions in theoretical mechanics and geometry. On this head we might dwell long, and find ample matter, both for reflection and wonder, but it would require not volumes merely, but libraries, to enumerate and describe the prodigies of ingenuity which have been

lavished on every thing connected with machinery and engineering." —p. 63.

Part II. consists chiefly of a demonstration of the advantages of the inductive system in the pursuit of philosophical truth, with illustrations of its wonderful success in many instances in leading to the discovery of the secrets of nature, and examples of the method of applying the process. The following rules for the observation of natural phenomena may give an idea of the clearness and conciseness of this part.

"145. When we would lay down general rules for guiding and facilitating our search among a great mass of assembled facts, for their common cause, we must have regard to the characters of that relation which we intend by cause and effect. Now these are,

"1st. Invariable connexion, and, in particular, invariable antecedence of the cause and consequence of the effect, unless prevented by some counteracting cause. But it must be observed, that in a great number of natural phenomena, the effect is produced gradually, while the cause goes on increasing in intensity, so that the antecedence of the one, and the consequence of the other, becomes difficult to trace, though it really exists. On the other hand, the effect often follows the cause so instantaneously, that the interval cannot be perceived. In consequence of this, it is sometimes difficult to decide of two phenomena constantly accompanying one another, which is the cause or which the effect."

"2nd. Invariable negation of the effect with absence of the cause, unless some other cause be capable of producing the same effect."

"3d. Increase or diminution of the effect, with the increased or diminished intensity of the cause, in cases which admit of increase and diminution."

"4. Proportionality of the effect to its cause in all cases of *direct unimpeded* action."

"5th. Reversal of the effect with that of the cause."

In the course of illustrating these and other rules, Mr. Herschel again displays his talent for agreeable and pertinent anecdote; for instance, in cautioning against the prejudices of the senses—fatal obstacles in the pursuit of truth—he proceeds thus:—

"72. To give one or two more examples of the kind of illusion which the senses practise on us, or rather, which we practise on ourselves, by a misinterpretation of their evidence; the moon at its rising and sitting appears much larger than when high up in the sky. This is, however, a mere erroneous judgment; for when we come to measure its diameter, so far from finding our conclusion borne out by fact, we actually find it to measure materially less. Here is eye-sight opposed to eye-sight, with the advantage of deliberate measurement. In ventriloquism we have the hearing at variance with all the other senses, and especially with the sight, which is sometimes contradicted by it in a very extraordinary and surprising manner, as when the voice is made to seem to issue from an inanimate and motionless object. If we plunge our hands, one into ice-cold water, and the other into water as hot as it can be borne, and, after letting them stay in awhile, suddenly transfer them to a vessel full of water at a

blood-heat, the one will feel a sensation of heat, the other of cold. And if we cross the two first fingers of one hand, and place a pea in the fork between them, moving and rolling it about on a table, we shall, (especially if we close our eyes,) be fully persuaded we have two peas. If the nose be held while we are eating cinnamon, we shall perceive no difference between its flavour and that of a deal shaving."—p. 82.

Here felicity of illustration is perhaps carried to its utmost extent, and one beauty of the instances, or most of them, is, that they are so simple, as to admit of being put in practice by any one with hardly any preparation.

In the third part, each science is considered separately; its characteristics are given, with a brief outline of its history. Of these, the most space is devoted to astronomy, chemistry, and electricity, on the wonders of the latter of which sciences, our author seems to dwell with the greatest satisfaction. The information he gives on each subject is very extensive, when the size of the book is taken into consideration; and, at the same time that it is, in one sense, satisfactory, it leaves the reader still so unsatisfied as to desire further information, and, consequently, to go further than this Preliminary Discourse can be expected to carry him—an effect which the writers of elementary works should always endeavour to produce, although few can expect to succeed in the same degree as Mr. Herschel.

Throughout the work, the astonishing progress made in every department of physical science, within the last few years, is so strikingly displayed, that the author is very appropriately led to conclude with a sketch of the causes which have led to this advance. One of the most important of these is thus noticed:—

"284. The telescope, as it exists at present, with the improvements in its structure and execution which modern artists have effected, must assuredly be ranked amongst the highest and most refined productions of human art; that in which man has been able to approximate more closely to the workmanship of nature, and which has conferred upon him, if not another sense, at least an exaltation of one already possessed by him that merits almost to be regarded as a new one. Nor does it appear yet to have reached its ultimate perfection; to which, indeed, it is difficult to assign any bounds, when we take into consideration the wonderful progress which workmanship of every kind is making, and the delicacy, far superior to that of former times, with which materials may now be wrought, as well as the ingenious inventions and combinations which every year is bringing forth for accomplishing the same ends by means hitherto unattempted."—p. 256.

It is pleasing to see a man of learning thus liberally acknowledging the obligations of philosophy to the mechanical arts. It is certain that without them astronomy could not possibly have taken the rapid strides it has made within the last half century.

We conclude by heartily recommending the work under review to our readers; we shall be surprised if by its means many, who are now insensible to the charms of philosophic research, shall not join the ranks of science; if many, whose names are destined to become

enrolled in the lists of fame as diligent observers of the natural world, or furtherers of the discovery of physical truth, shall not date their resolution of attempting to penetrate the mysteries of nature from their perusal of Herschel's Preliminary Discourse on the Study of Natural Philosophy. [*Mechanics' Magazine.*

On the Mode of Ascertaining the Commercial Value of Ores of Manganese. By Edward Turner, *M.D., F.R.S.L. and E., Sec. G.S. Professor of Chemistry in the University of London.*

The analysis of the ores of manganese, when pure, is exceedingly simple. The operator need only, by well known methods, determine the water which the ore contains, and the oxygen which it loses in being converted into the red oxide. Its degree of oxidation, on which the commercial value of ores of manganese so essentially depends, may then be readily inferred.

But when impurities prevail, as they almost always do, more or less in commercial manganese, the analytic process is complex and troublesome; and the presence of iron, which is rarely absent, renders an exact result by the ordinary modes of analysis almost impracticable. For, as I have elsewhere stated,* when peroxide of iron is strongly heated in mixture with peroxide or deutoxide of manganese, oxygen is given out by the former as well as by the latter; and, accordingly, the oxygen lost by heat ceases to indicate the nature of the manganese. A moderately correct allowance for the quantity of oxygen emitted by the iron under these circumstances would be difficult, even after ascertaining in the moist way the quantity of iron contained in the ore; since the constitution of the resulting oxide of iron, as well as its uniformity, is probably variable, and, at all events, is undetermined. The chemist would, therefore, have to ascertain separately each constituent of the ore, and consider the loss as oxygen belonging to the manganese,—a method not to be trusted in a complicated analysis, and which would be wholly inapplicable if the iron, as contained in the ore, should happen not to be uniformly oxidized.

I was led to reflect on these difficulties in consequence of being requested, some months ago, to examine a considerable number of different ores of manganese, the object being solely to ascertain the relative quantities of chlorine which an equal weight of each ore was capable of supplying; and as the method to which I had recourse gives such information with rapidity and precision, I have drawn up a short description of the process; not from any novelty being attached to it, but in the belief that it may be useful to persons engaged in a similar inquiry.

The method, in principle, consists in dissolving a given weight of the ore in muriatic acid, condensing the chlorine in water, and, by some uniform measure, estimating the quantity of chlorine relatively to an equal weight of pure peroxide of manganese, selected as a

* Brewster's Journal of Science, N. S. ii. 213.

standard of comparison. The substance first used with this intention was a solution of indigo; but a weak solution of green vitriol, employed by Mr. Dalton for ascertaining the strength of bleaching powder, was found to be more precise in its indications.

The method of manipulating is as follows:—About ten grains of the ore in fine powder is introduced into a flask capable of containing about an ounce of water, and into its neck is fitted, by grinding, a bent tube about two inches long, which conducts the chlorine from the flask into a tube about sixteen inches in length, and five-eighths of an inch wide, full of water, and inverted in a small evaporating capsule, employed as a pneumatic trough. The apparatus being adjusted, the flask is half filled with concentrated muriatic acid, the conducting tube instantly inserted, and heat applied by means of a spirit-lamp. The air of the flask, together with the chlorine, is then collected, the greater part of the latter, if the gas is not very rapidly disengaged, being absorbed in its passage; and, consequently, the receiving tube, at the close of the process, will be about half full of gas. When the ore is completely dissolved, the last traces of the chlorine are expelled from the flask by muriatic acid gas. In order that the chlorine thus collected may be entirely absorbed, the aperture is closed by a ground stopper, or, still more conveniently, with the finger, and the gas is well agitated until the chlorine is wholly absorbed. As the solution in the inverted tube may become too much saturated to dissolve all the chlorine, it is convenient to fill a pipette with pure water, and, with the aid of the mouth, force a current to ascend into the tube, and thereby cause the heavier solution to flow out into the capsule.

The absorption being complete, the solution of chlorine is introduced into a six or eight ounce stoppered bottle, and a dilute solution of green vitriol, made, for example, with a hundred grains of the crystallized salt and a pint of water, is added in successive small quantities until the odour of chlorine just ceases to be perceptible. The quantity of liquid required for the purpose may be conveniently measured in a tube about sixteen inches long, and three-quarters of an inch in diameter, divided into two hundred parts of equal capacity, and supplied with a lip, so that a liquid may be poured from it, without being spilled. In conducting this part of the process, the operator will perceive two odours:—at first, the characteristic odour of chlorine, accompanied with the peculiar irritation of that gas;—and, subsequently, an agreeable, somewhat aromatic odour, unattended with the slightest irritation. The object is, to add exactly so much solution of iron as suffices to destroy the former of these odours, without attempting to remove the latter; a point which, with a little practice, may be readily attained. The whole of the iron is thus brought into the state of peroxide.

The first trial is generally accompanied with some loss of chlorine, and should only be used as a guide to a second and more precise experiment. Accordingly, a weighed portion of the same ore is dissolved, and the chlorine collected as before, except that the solution of green vitriol, in quantity rather less than sufficient, is at once introduced into the inverted tube and capsule. A more ready

and perfect absorption of the chlorine is thus effected, and the subsequent addition of a small quantity of sulphate of iron suffices for completing the process.

The principal sources of error in this method are the two following:—loss of chlorine, by smelling repeatedly, and exposure to the air when the gas is absorbed by pure water; and oxidation by the air when the absorption is made directly by means of the solution of iron. The small flask and inverted tube are apt to retain the odour of chlorine, and should therefore be rinsed out with the absorbing liquid. It should be remembered, also, that a given quantity of chlorine will emit a more or less distinct odour, according as it is less or more diluted. But by operating always in the same manner, and employing such weights of different ores, that equal quantities of the solution may contain nearly equal quantities of chlorine, it is easy to be independent of these errors of manipulation, by causing them to affect each experiment to the same degree. It will accordingly be found, with a little practice, that results of surprising uniformity may be thus obtained; and even the constitution of pure oxides of manganese may be ascertained by this method, almost with the same accuracy as by directly determining the quantity of oxygen. [*Jour. Royal Institution.*

Bent Axle and Dished Wheels.

Extract from an Essay "on the Construction of Wheel Carriages," by J. S. Fry, Bristol, Eng.

"I know no prejudice more firmly rooted than that in favour of dishing or conical wheels. Much has been written, and well written, to show, and to prove, the absurdity of the use of them, but hitherto with very little effect. I think the principles, and the effects of them, may be stated in very few words.

"Carriages are intended to travel straight forward: they ought, therefore, to be furnished with wheels, the natural tendency of which should be to go straight forward. The same with a garden-roller; suppose any man was to have a garden or a field-roller, made six inches less in diameter at one end than the other; what would not even the wheel-wrights say of such a man? Yet such an act would be a counterpart of their own, when they recommend broad conical wheels. The natural course of a rolling cylinder is a straight line; and the natural course of a rolling cone is a circle. Let us reverse their natural courses—that is, let us make a cylinder travel in a circle, and a cone in a straight line. It must be obvious that, when each of these bodies is forced to travel contrary to nature, in the course of the other, there must be a constant dragging, or twist, on the ground, to keep it in its unnatural course. Such would be the case if a man was to drag a common garden-roller round in a small circle; and such, too, would be the case, if a man was to drag straight forward a garden-roller, made six inches less in diameter at one end than at the other. The effect in both cases would be precisely the same. Each operation would be attended with prodigious

labour; and the roller, in each case, by its twist on the ground, would break up and derange the gravel beneath. Now it is well known that the machine constantly in use, in numberless manufactories, as the best that has hitherto been invented for expeditiously and effectually grinding to powder the hardest and toughest materials, is a cylinder forced round in a circle. Therefore, as a cylinder moving in a circle is the best machine that the ingenuity of man has hitherto produced for pulverizing the hardest and toughest materials, and as this is effected by the twist or drag produced between the edge of the cylinder and the surface on which it rolls, and as the twist or drag is precisely the same in the case of a cone forced straight forward, I think I may be borne out in my opinion, that a heavy wagon, with broad conical wheels, is the most complete, the most efficacious machine that the art of man, in the present state of science, could construct for grinding to powder the materials of our roads.*

"And it is also true that, as the wheel grinds the road, in that proportion does the road grind the wheel. The tire of cylindrical wheels, therefore, would last probably many times as long as that of conical wheels.

"It appearing, then, that the cylindrical wheel only has a natural tendency to roll straight forward, all carriage wheels ought to be so constructed. Consequently, the ends of *the axles ought not to be conical, or tapered, nor bent down*, as they are now made; but the axle ought to be put into a lathe, and both ends turned, like the two ends of a spindle for mill work, cylindrical: that is to say, of the same size, or diameter, at the ends as they are at the shoulders; and, of course, the boxes in the wheels should be cylindrical also.

"It should be known that wheels of this construction are liable to only three-fourths of the usual toll, by the 55th Geo. III. chap. 119, at the discretion of the trustees.

"It being shown above that the conical wheels of broad-wheel wagons are the same in operation and effect, on the materials of the roads, as drug-mills, it follows, of course, that all that portion of labour which is applied to the conical wheel, to keep it in a straight course, more than would be required to impel it in its natural circle, is so much power not merely wasted, but most mischievously and most effectually applied in grinding the materials of the road into powder; and as these wagons weigh, in summer, eight tons each, the silent mischief effected by these four drug-mills, of two tons weight each, is great beyond calculation. How much power is thus misapplied may be conceived, as it frequently requires ten of the heaviest horses to draw it—which is just sixteen hundred weight each; a weight sometimes drawn by light horses, in stage-coaches, and at least at three times the pace." [*Mechanics' Magazine.*

* On looking over the Essay on Wheel Carriages, published in the year 1813, by Richard Lovell Edgeworth, I find the same comparison in illustration of the effects of broad conical wheels. But as the above is copied from my own manuscript, written twenty years ago, I hope not to incur the charge of plagiarism.

To restore the Elasticity of Damaged Feathers.

A feather, when damaged by crumpling, may be perfectly restored by the simple expedient of immersing it in hot water. The feather will thus completely recover its former elasticity, and look as well as it ever did. This fact was accidentally discovered by an amateur ornithologist of Manchester. Receiving, on one occasion, a case of South American birds, he found that the rarest specimen it contained was spoilt, from having had its tail rumpled in the packing. Whilst lamenting over this mishap, he let the bird fall from his hands into his coffee cup; he now deemed it completely lost, but, to his agreeable surprise, he found, that after he had laid it by the fire to dry, the plumage of the tail became straight and unruffled, and a valuable specimen was added to his collection.

[*Jour. Royal Institution.*

Meteorological Observations for April, 1831.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2, P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain and snow.	State of the weather, and Remarks.
				Inches	Inches.			Inches.	
	1	48°	59°	29.70	29.80	West.	Moderate.		Clear day.
	2	41	64	.95	.95	SW. S.	do.		Clear day.
	3	44	68	.80	.80	SE. SE.	do.		Clear.—Overcast.
	4	47	51	.80	.80	S. SE.	do.	·45	Rain drizzle--foggy-rain.
☾	5	45	51	.55	.85	W. NW.	do.		Cl'dy-cl'r [thun. & light.
	6	37	63	30.10	30.10	W. SW.	do.		White frost—clear.
	7	45	67	25.95	29.90	SW. S.	do.		Clear day.
	8	51	68	29.80	.55	South.	Blustering.	.15	Clear—cloudy—rain.
	9	37	44	.20	.40	W. NW.	do.		Flying cl'ds—snow squall.
	10	32	53	.70	.60	W. SW.	do.	.08	Clear—flying cl'ds—rain.
	11	45	50	.50	.50	SW. W.	do.		Cloudy day.
⊗	12	31	41	.76	.85	W. NW.	do.		Clear day.
	13	33	60	30.00	30.00	W. SW.	Moderate.		White frost—clear
	14	40	68	29.96	29.93	SW.	do.		Clear—overcast.
	15	54	62	.80	.90	South.	do.		Rain—cloudy.
	16	55	58	.80	.75	S. E.	do.	2.42	Rainy day.
	17	54	70	.88	.80	NE. NW.	do.		Cloudy—flying clouds.
	18	52	72	.85	.85	NW. W.	do.		Clear day.
☽	19	54	71	.75	.75	West.	do.		Cloudy—brilliant aurora
	20	52	74	.75	.70	S. W.	Blustering.		Cloudy—clear [borealis.
	21	51	60	.70	.80	NE. W.	Moderate.	.03	Cl'dy day—rain in night.
	22	46	64	.70	.70	S. E.	do.	.24	Cl'dy day—thun. shower.
	23	44	55	.70	.70	S. E.	do.	.10	Cloudy—rain in night.
	24	44	54	.70	.70	West.	do.		Clear—flying clouds.
	25	45	64	.63	.60	W. NE.	do.		Flying clouds.
☉	26	46	61	.64	.73	East.	do.		Cloudy day.
	27	45	54	.80	.80	N. E.	Blustering.		Cloudy day.
	28	40	43	.50	.50	East.	do.	2.00	Rainy day.
	29	38	51	.33	.35	West.	do.	.05	Rain—cloudy.
	30	45	56	.40	.40	do.	do.		Cloudy day.
	Mean	44.70	59.30	29.72	29.73			5.58	In. of rain in the month.

	Thermometer.	Barometer.
Maximum height during the month,	74. on the 20th	30.10 on the 6th.
Minimum do.	31. on the 12th,	29.20 on the 9th.
Mean do.	51.93	29.725